



WILLIAM NEWTON, ARCHD.

THE
ARCHITECTURE
OF
M·VITRUVIUS·POLLIO:

TRANSLATED
FROM THE ORIGINAL LATIN,
BY
W. NEWTON, ARCHITECT.

VOLUME THE FIRST.

L O N D O N:

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M.DCC.XCI.

T O T H E K I N G.

May it please your Majesty,

TO permit me to present you with the first English translation of the Architecture of M. Vitruvius Pollio, inscribed by the author to the great Augustus, or perhaps, with greater probability, to the benevolent Titus. The works of this writer have ever been judged worthy of the patronage and attention of the sovereigns of those countries in which they have respectively been published. The public having favourably received my former endeavours on this subject, I now presume to solicit that protection which works only of approved merit can deserve.

The whole being now complete, I am encouraged to present it to your Majesty, as the patron and judge of the art which is here taught and exemplified.

The great advances which this, as well as other sciences, have made during your Majesty's reign, strongly prove the encouragement they have received. I shall have attained the utmost reward of my labours, should they in any degree contribute to the promoting your Majesty's intentions, or tend to the use and advantage of my country.

I remain

Your Majesty's obedient Servant,

And dutiful Subject,

WILLIAM NEWTON.

TO THE PUBLIC.

AS the appearance of these Volumes, after the decease of their Author, may possibly occasion, in the minds of some persons, an idea that part of their contents is not the genuine performance of my Brother, the late Mr. WILLIAM NEWTON, it will be proper in this place to inform the Public, that the Letter-Prefs of the First Volume, and of a great part of the Second, was printed before his death; and, since that period, the remaining part has been carefully printed from a correct manuscript copy prepared by himself; and which, conformable to his Will, came into my possession, with his express orders for completing and publishing the Work. The Plates were likewise chiefly finished before his decease; those which have been since engraved, were copied from his own highly finished Designs; and the Portrait was engraved from a Drawing taken only a few weeks previous to that unfortunate event. The Work, in this very advanced state, came into my possession; and the part which devolved upon me having been executed with a strict regard to his instructions, I hope I shall be justified in asserting, that the whole Work, as here presented to the Public, is precisely what its Author intended.

*Thornhaugh Street,
Bedford Square.*

JAMES NEWTON.

P R E F A C E.

WHILE all the polished nations of Europe possess a Translation of the Architecture of M. Vitruvius Pollio, whereby their architects have the opportunity of perusing, in their own language, the father of their art, Great Britain, and its extensive dominions, remain without that advantage; and the British architects (for the major part) without the knowledge of the most ancient writer on the subject whose labours have reached our times.

THE nations around us having been all long since thus provided, it may seem to cast some reflection on our taste and talents for the fine arts, that we have so long neglected this distinguished author. The art he teaches is one of the most useful, elegant, manly, and comprehensive, in which the strongest intellects and most fertile fancy may have scope to move, and the efforts of the judgment and genius may be shewn united.

BUT our neglect of the arts hitherto, and the little figure we have made therein, may probably be owing to our intestine commotions, and the unsettled state of the nation for many years past. The arts could not be regarded, while objects more essential to the public good were struggling, and in hazard. Italy long enjoyed a profound tranquillity; there therefore the arts revived and flourished, but now seem to be retiring. We may observe also that the course of the arts, as well as of empire, has been directed westward; and they may not yet have arrived at the full zenith of our isle. They however now appear to be advancing apace, and there is a prospect that they will reach their utmost height and perfection in this nation.

LONG before I entertained any thoughts of this undertaking, I had frequently occasion to observe the want of an English translation. To have recourse to the text, on all occasions, is not sufficiently expeditious in business for those who are not exceedingly well versed in the Latin, nor indeed for those who have not particularly studied the style and terms of this author. It is true that the majority of those who have wrote on architecture have drawn the principles they inculcate from the text of Vitruvius, and their writings are in a great measure transcripts of his; they, nevertheless, do not answer the end of a translation: the precepts of Vitruvius are often promiscuously blended with their own ideas, or interpreted in such a manner as to serve a particular purpose; by which means the sense of the original is perverted or misrepresented.

PERAULT, in the preface of his French translation, attributes the difficulty of translating this author to the necessary qualifications for such a performance rarely meeting in one person. An architect, bred chiefly to the knowledge of his profession, is seldom sufficiently skilled in language, and several other requisite sciences; and very few men of literature have a knowledge of architecture, and a genius for the fine arts, sufficient to enable them to undertake the task; the turn of mind adapted to the one seeming unsuited to the other kind of studies: we may add likewise, that, in those who may be sufficiently qualified, the inclination and opportunity to exert their abilities in such a work do not always concur. To wait, therefore, till all these requisites unite, might be endless; and it may be preferable to

avail ourselves of an inferior performance, in some degree useful, than to be wholly without the knowledge of this author. These reasons, and seeing it neglected by others, have induced me to attempt this arduous undertaking; not vainly presuming on abilities equal to the task, but hoping that in the knowledge of the principal subject, and in some degree at least of the several necessary qualifications, I may not be found deficient.

THE esteem in which the writings of this author have ever been held, is apparent from the number of manuscripts, printed editions, and translations into all the European languages which have been made thereof. The fifteenth century, the time when the fine arts began to revive, gave birth to many printed editions, comments, and translations of this author, in sundry parts of Europe: of these it is proper to give some account.

THE first printed edition of the text was that of Sulpitius, which appeared about the year 1486. In 1496, one was printed at Florence; and in 1497, another at Venice. In 1511, Jocundus published a new edition at Venice, which he reprinted, with corrections, at Florence, in 1513, 1522, and 1523. In 1521, the first translation was made in Italian, by Cæsar Cesariani, and published at Como, in the Milanese. Another Italian translation was published by Lucio Durantino, at Venice, in 1524, and again in 1535. In 1536, an Italian translation of the first five books, by Giovanni Baptista Caporali, was published in Perugia.

IN 1542, *A Compendium of the Writings of Vitruvius*, in the Spanish tongue, was published at Madrid, by Don Didaco Sagredi, which was reprinted at Toledo, in 1549 and 1564. A new Latin edition was printed at Strasburgh, in 1543, and again in 1550.

IN 1544, Philander published his *Latin Annotations on the ten Books of the Architecture of Vitruvius*, incited thereto by Francis the First, styled *The Restorer of the Liberal Arts*; but, in these annotations, more regard is shewn to literary punctilios, and the etymology of the Greek and Latin terms, than to the illustration of the architectural matters.

IN 1547, the year Francis the First died, the first French translation appeared, executed by Jean Martin, secretary to the Cardinal de Lenoncour, with the assistance of J. Goujon, architect to the kings Francis the First and Henry the Second: this was dedicated to the latter of the two kings, though that compliment was evidently intended to the former, had not his death prevented it. This translation, which was made by a man of letters, who had not a competent knowledge of architecture, is found to have very little merit; it was, however, reprinted in 1572, and again at Cologne in 1618.

IN 1548, a German translation, with notes, was published at Nuremburgh, by Gualter Rivius; which was republished at Basil, in Switzerland, in 1575 and in 1614. This translation is commended by Sir Henry Wotton, in his *Elements of Architecture*.

IN 1552, Philander published, at Lyons, a Latin edition of Vitruvius, with annotations; and again in 1586 at Geneva.

IN 1556, the learned Daniel Barbaro, patriarch of Aquileia, published an Italian translation of Vitruvius at Venice, with draughts and copious annotations; in which it is probable he had the assistance of that celebrated and ennobled architect Andrea Palladio; their draughts, as well as their explanations of sundry passages of the text, exactly corresponding. This translation was again published in 1567, accompanied with a new edition of the text, and comments by the same hand; and the translation was again published at Venice, in 1629.

AN Italian translation was intended by Giovanni Antonio Rusconi, but his death prevented its appearance: the draughts he left were, however, collected by Giolito, and published at Venice in 1590, with short explanations annexed. Many manuscript translations are said to be dispersed about Italy, which were never printed; one is now

preserved in the Vatican library, at Rome; and another in the Corsini library, believed to have been made by Sangallo.

IN 1649, a valuable edition of the text, with comments extracted from Philander, Barbaro, Salmasius, and other commentators, was published at Amsterdam, by J. de Laet, and dedicated to Christina, Queen of Sweden; to this was annexed, *The Elements of Architecture*, wrote by our countryman Sir Henry Wotton, and *The Comments of Marcus Meibonius on Vitruvius*; the *Dissertation of Nicholas Goldmanus on the Ionic Volute*; and the *Lexicon of Bernardino Baldus*, explaining the unusual words and technical terms made use of by Vitruvius; together with his *Treatise on the Scamilli Impares*, mentioned in the third chapter of the third book.

AFTER this comes the pompous French translation, executed by the learned Claude Perault, physician and architect, at the command and expence of Lewis the Fourteenth, enriched with numerous comments and elegant engravings. This was published in 1673, and indeed much excelled all the preceding translations: it was again published, with corrections, in 1684.

SINCE this, divers men of erudition and ingenuity have wrote comments on the writings of Vitruvius, particularly the Marquis Poleni, in his treatise styled *Exercitationes Vitruvianæ*, published in 1739 and 1741. An edition of the text has been long expected from the same hand, but has never yet appeared.

OUR countryman, John Evelyn, Esq. F.R.S. must not be wholly omitted. He has given some pertinent remarks on the terms of Vitruvius, in his translation of the *Parallel of the Ancient Architecture with the Modern*, which he published in 1664, and dedicated to Charles the Second.

ROBERT Castel, in his *Villas of the Ancients*, which he published in 1728, and dedicated to Richard Earl of Burlington, professes that he undertook that treatise as a preparative to a translation of Vitruvius into the English language; a work he had long entertained a desire of performing. This intention of Robert Castel was mentioned in the *Acta Erudit. Lipsiæ*, 1731: he, however, never fulfilled his promise; and it is probable that his immature death prevented his design.

LASTLY, in 1758 appeared, at Naples, an edition of the text, joined with an Italian translation, dedicated to the King of Naples, by the Marquis Berardo Galiani; this performance has eclipsed all the preceding. The Marquis has made several new and useful illustrations; he very strictly adheres to the text; and his comments are judicious, and chiefly relative to the principal subject, architecture, which most of the former commentators have too much neglected. To the labours of this author I must acknowledge myself much indebted; they have been of considerable service to me in the course of this undertaking, although our sentiments have not in every circumstance coincided.

IT is now necessary to speak of this translation, and to give some account of the methods pursued in the conduct thereof, in order to render it more intelligible to the reader.

I HAVE made use of the printed editions of Barbaro, De Laet, and Galiani; and, when occasion required, of sundry manuscripts. I have in no place, as I recollect, taken the liberty to alter or depart from the text; but, if any difficulty or ambiguity has occurred, have remarked it in the notes, and given the opinions of the commentators, or my own thoughts, thereon. Many reasons concurred to induce me to be as literal in the translation as possible: this has often occasioned me to run into the Latin idiom, which, although it may read less fluently, will not be less intelligible; and, by

conveying the meaning more exactly, may be in some respects more useful. The numerous ambiguities, the peculiar style, and use of the technical terms, made it impossible to be avoided without much circumlocution, or the hazard of perverting the sense of the author; and this, those who are best acquainted with the uncertainty and perplexity of the text in many parts, will not, I believe, be the most forward to censure.

IN order to avoid a multiplicity of words and explanations, I have made use of letters of reference, which are placed next to the word referred from: such of these as are not in the text, and have not been used by Vitruvius himself, are inclosed in parentheses; and wherever it has been necessary, for the sake of rendering the passage more intelligible, to add a word that is not drawn from the context, it is usually inclosed in a parenthesis.

THE modern technical terms being very indeterminate and uncertain, differing in different times, places, and persons; and, in our own language, being almost wholly borrowed from the Italian or French, I have thought it most advisable to adhere to the Latin terms entirely, and to explain them where necessary in the notes; the reader will, therefore, find the explanation of any unknown term at that place where it is first mentioned, as well as at other places, by the letters of reference and figures.

IN making the draughts, I have followed the order in which they are described by Vitruvius, numbering them from the first onward, so that they may be bound at the end of the several books to which they respectively relate, in the manner they were disposed by Vitruvius himself; or altogether, at the end of the whole; or each opposite to the page wherein it is described.

THE draughts which Vitruvius himself made, and annexed to his book, are all lost; so that his commentators have been obliged to compose them anew from his descriptions. In doing this, as well as in investigating the sense of the obscure passages of the text, I made it a rule to collect my own ideas on the subject, before I allowed myself to learn those of others; after which, I examined and consulted all others I could meet with; and from the whole, with as much impartiality as I could master, selected that which I judged the most consistent, and most conformable to the intention of the author. To this method, the several corrections and new illustrations, which I think will be found in the ensuing work, are chiefly owing: the previous knowledge of the ideas of others so influences the mind, that it becomes almost impossible, or at least very difficult, to think in any other track.

IN the comments, I have chiefly attended to the explanation of the architecture, and of matters relative thereto; leaving other subjects, as being out of my province, to be discussed by those who are more concerned in such studies.

THE division into chapters is not used in any of the manuscripts I have met with, and was probably not done by Vitruvius, the ancients not using that mode of dividing their writings: it is said to be found in some manuscripts, having been done, as it is supposed, by the copyists; and is used in all the printed editions. I have therefore thought proper to retain it in this translation; as, by dividing and distinguishing the several subjects, it facilitates the discovery of any part of the discourse, and helps the memory.

I HAVE had now and then occasion to give my own opinion. This, I believe, I have generally done without accompanying it with any of the usual terms of diffidence or humility; they are omitted to avoid unnecessary affectation, and for the sake of brevity: the reader is therefore requested not to impute that omission to confidence or self-conceit. I wish it to be understood that I speak my sentiments with that diffidence that becomes every man. I have endeavoured to be in the right; but, if I have failed, I shall with pleasure see my errors corrected. My aim is truth; and, by whomsoever it is found, it is to me equally welcome and acceptable.

IN perusing the following treatise, the reader will meet with several passages that will occasion him to reflect on the difference between Vitruvius's manner of teaching the art and that made use of by modern masters; the former directs us to vary the proportions and dispositions of the members according to the magnitude, situation, purpose, and other circumstances of the building; the latter offer no rules of that kind, but prescribe a certain fixed modulation of the parts of each order, to be used in all edifices, however circumstanced: each author recommending such as his peculiar studies, or some other accidents, have occasioned to make a favourable impression on his mind. But I see no reason for such a partial attachment to any certain manner, nor merit in such indiscriminate application of it; it appears more like mechanism than intelligence: the weakest understanding and poorest genius may be capable of attaining such a habit. It is, indeed, the general fate of artists to be mannerists; but it is not on that account less erroneous, nor ought it to be less opposed.

I imagine that every building should by its appearance express its destination and purpose; and that some character should prevail therein which is suitable to, and expressive of, the particular end it is to answer. To effect this, will require the exertion of the powers of the mind, the fire of genius, and the solidity of judgment; and, without this, a composition is but a compilation of parts, without meaning or end.

*ARCHITECTURE may be distinguished into the essential and the ornamental parts: the first regards the real qualities of buildings, their convenience, strength, &c.; the other has relation only to their outward appearance, or effect. In the former respect, architecture ranks with those arts which relate to the necessities and conveniences of life; in the latter, with the arts of entertainment, painting, poetry, and music, called the liberal arts.**

SOME may object that, as the end of all compositions in the liberal arts is to entertain, provided they appear pleasing, it is sufficient, without regarding whether that appearance is suitable and adapted to the circumstances of the work. It is true that such an appearance will be sufficient to please the fancy, but not to satisfy the judgment. Works of art should please by their propriety as well as beauty; and a pleasing appearance, that is suitable to the work, must certainly be preferable to one that is unsuitable: the gaiety and lightness of a villa may be equally pleasing if applied to a prison or a castle; but no one can affirm that they will be equally proper and well adapted. Beauty will, by repetition and continuance, lose its effect; but propriety will maintain and produce its effect for ever. It may be added, also, that works of art may be directed to the elevation and improvement of the mind, as well as to its entertainment only, by exciting worthy or generous sentiments; and that this, perhaps, should be considered as their ultimate end, to which the pleasure they afford is only the attractive means.

IT appears, therefore, that the first care of an architect, when he is about to design any building, should be, to consider the full destination and purpose of the edifice, from thence to determine the character which is proper and suitable thereto, and then to compose the building in such a manner as to be expressive of such character. I am now speaking only of the appearance and ornamental part of buildings; not of their convenience, strength, or other essential qualities, which are understood to be always first regarded.

THE appearance of any character in an object, I suppose to be the result of the particular modification of its component parts, and the aptness and allusion of the ornaments. To modify an object, is to vary or graduate its sensible properties. In architecture, and other arts respecting the sight, such properties only as are visible are to be attended to, viz. all that relate to figure and colour; and, in other arts, such properties as relate to the senses to which those arts respectively belong.

(*) Architecture, as well as sculpture, is included by the word painting, which, in this case, is understood to signify all those arts of entertainment whose effects are perceived by the sense of seeing, as music and poetry do those which relate to the hearing and understanding.

THE destination of a building is divisible into three heads ; as, for example, the use it is to serve, the place in which it is to be situated, and the person for whose use it is intended : each should be considered in determining the character suitable to the building.

THE characters or effects which there may be occasion to express in buildings, may be distinguished into the pleasing and the elevating, or those of beauty and dignity. The several characters of either class might be ascertained, as well as the kinds and degrees of the sensible properties that will produce the appearance of each character : but it would carry me farther than I intend in this preface ; in which I only mean to give a general sketch of my sentiments on this matter, in order to shew the opening there seems to be for a full disquisition of the subject, and the possibility of bringing the art of designing in architecture (which, at present, has no guide but fancy or habit) to some regulation and certainty.

OBSERVATIONS

CONCERNING THE

LIFE OF VITRUVIUS.

WE know little more concerning Vitruvius than what is to be gathered from his own writings. From these we learn, that his parents caused him to be early instructed in architecture, as well as in many other sciences. We have no account of his parents, or the place of his birth: but he was doubtlessly a native of some part of Italy, if not of Rome itself; for, in sundry parts of his book, he uses the words *nos*, *noſter*, &c. to distinguish the Romans, and their buildings, from all others. By the knowledge he appears to have had of divers nations, and their public edifices, it is very probable that he had spent much of his time in travel. He tells us he had acquired some fortune, as well as reputation, by his profession; but, in his sixth proem, he says, it was not to be wondered at that he was so little known; for he had not, like the generality of architects, been forward in soliciting and petitioning for employment, having learnt not to be solicitous of care, and being ashamed to request advantages.

He was one of the engineers of the Roman army; civil and military architecture being at that time united and practised as one profession. From his own words, in his second preface, we learn that he was low of stature, and was old and infirm when he published his writings. The period in which he wrote, and the emperor to whom he dedicated his books, are points not yet ascertained; some arguing for the time of Augustus, and others for that of one of the succeeding emperors, particularly Titus. The former opinion is, however, the most generally received; notwithstanding which, several circumstances that I have observed oblige me to incline to the latter. I will, therefore, here mention the principal arguments on both sides, that the reader may be able to judge for himself.

The arguments for the reign of Augustus are,

1st, That though Vitruvius, in the course of his work, makes mention of many remarkable public edifices that were erected before the reign of Augustus, he yet mentions none of those magnificent structures that were erected during or after that time; which it is probable he would not have omitted, had he wrote after that period.

x O B S E R V A T I O N S O N T H E

2dly, That Vitruvius does not treat of amphitheatres, which were common in the time of Titus, although scarcely known in that of Augustus ; and it is to be supposed that he would not have omitted treating of such large, elegant, and singular buildings, if they had been common at the time he lived.

3dly, That Vitruvius (Book III. Chap. II.) mentions *The Stone Theatre*, speaking in the singular number, which implies that there was but one stone theatre in his time (*viz.* Pompey's theatre) ; and as there was but that one in the beginning of Augustus's reign, and as several were erected during that and the two or three following reigns, it is probable that Vitruvius wrote at a time when there was only that single stone theatre subsisting, and consequently in the time of Augustus ; for if there had been several stone theatres at the time he wrote, he could not have distinguished one by that title, to which they all had an equal right. And,

4thly, That the manner in which Vitruvius mentions the authors Accius and Ennius, and also Lucretius, Cicero, and Varro (the two former as ancient, the three latter as living in or near his own time), agrees perfectly well with the time of his writing, supposing it to have been in the reign of Augustus.

It must be allowed there is some force in these arguments, but they cannot be said to be entirely conclusive ; for the first argument only proves that Vitruvius did not write much before the time of Augustus, and in no wise renders it evident that he did not write long after. If he mentions none of those buildings that were erected during or after the reign of Augustus, it may be supposed he had no occasion to mention them ; they might not be the examples he wanted.

In answer to the second argument, it may be said, that though Vitruvius does not treat of amphitheatres, yet neither does he treat of circuses, which were buildings equally worthy of description, and had been in use some ages before the time of Augustus. But, as he mentions both these kinds of buildings, it is certain that amphitheatres were in use in his time. Why he did not describe them we know not : however, his not describing them is no proof that they were unknown when he wrote ; on the contrary, his manner of mentioning them, implies they were in common use in his days : and, as we know by history that those buildings were not in common use till near the time of Titus, it consequently amounts to a proof on the other side the question, *viz.* that he did not write till near that time.

The third argument is answered by observing, that the theatre of Pompey, being the first built of stone, might of course be called the Stone Theatre at its first building, to distinguish it from all others, which at that time were of wood ; and, having obtained that appellation at first, might ever after retain it. So, in our days, Newgate still retains the name of one of our old city gates, and Pont Neuf of an old bridge at Paris, though the circumstance from which they first obtained those names (*viz.* their being then new) no longer exists. It is true we cannot be certain that this was the case with Pompey's theatre ; but neither can we be certain that it was not the case. This argument, therefore, is balanced, and is conclusive neither on one side nor the other.

The fourth argument is not more conclusive than the former ; for the manner in which Vitruvius mentions the authors there named, agrees as well with the time of Titus as with that of Augustus : for, as there was only a term of sixty-five years between the reigns of those two emperors, and as Vitruvius was old when he published his books, he might well consider the former two of those authors as ancient, in comparison of the latter three, who might have been living in or near his own time.

The arguments on the contrary side of the question are,

1st, The answer before made to the second argument concerning amphitheatres: where Vitruvius (L. I. C. VII.) expresses that, *in those cities which have no amphitheatre, the temple of Hercules is to be situated near the circus.* This implies that permanent amphitheatres were common in the cities of Italy at the time he wrote: but this could not be the case in the reign of Augustus, as the following circumstances will render probable:—The first amphitheatre upon record was built by Julius Cæsar, for the exhibition of the shows at the dedication of his forum and temple of Venus. This must have been only a temporary building; for, after the fourth consulate of Augustus, the shows given at Rome, on account of the victory at Actium, were represented in a wooden stadium or amphitheatre, built for the purpose in the Campus Martius. See Dio, l. liii. and liv. Statilius Taurus, indeed, about that time built a stone amphitheatre; but it was probably too small for the public shows, as we read of temporary wooden ones being built upon occasion by all the succeeding emperors down to Nero, who is said to have built a very large one within a year; and Suetonius (in Vespasian, f. 9.) says this emperor erected the large amphitheatre that Augustus intended to build. It appears probable, therefore, that Rome had no permanent amphitheatre, either of wood or stone, in the reign of Augustus, except that of Taurus; and if Rome had not, it is not credible, nor is there any authority for believing, that such expensive and novel buildings were common in the other Italian cities at that time.

The first amphitheatre out of Rome, that is mentioned in history, was at Fidenæ: it was built by Attilius, in the reign of Tiberius, and fell down while the spectators were sitting therein. This is mentioned by Suetonius and Tacitus. The latter author speaks of another wooden amphitheatre at Placentia, as being the largest in Italy, and which was burnt in the wars between Otho and Vitellius: he also says, Cecinna employed the soldiers in erecting amphitheatres for the entertainment of Vitellius, so that it seems to be about that time that these buildings became common in several cities of Italy; which therefore renders it probable that the time of Vitruvius was near that period.

I have been favoured with several pertinent objections tending to investigate the case, and which I shall notice as I proceed. One of these is, *that as Vitruvius (B. V. Ch. I.) says, the shows of gladiators are usually given in the forum, it is probable that he wrote before amphitheatres were in use; because it may be presumed that, after that time, the forum was no longer used for that purpose.* But the answer to this objection is, what has been just observed, that he also (B. I. Ch. VII.) speaks of amphitheatres as being in use, and even common, in the cities of Italy at the time he wrote. It appears evident therefore that the forum was sometimes used for these shows after amphitheatres had become common.

2dly, A similar argument may be maintained on the subject of theatres. In the 5th Book, Vitruvius treats fully of stone theatres built according to the Roman manner. This implies that more than one such theatre had been erected when he treated of them; for one only would not be sufficient to authorize the idea of a peculiar manner (*Quæ ex quadratis designantur, Græcorum; quæ ex paribus trigonorum lateribus, Latinorum habeant usus. L. V. C. VIII.*). Yet there was but one stone theatre in Rome till very far in the reign of Augustus, when those of Marcellus and Balbus were built. Vitruvius (B. V. Ch. V.) says that in his time there were stone theatres even in the Roman provinces (for they had the Echeian vases, and therefore must have been of masonry, since he expressly says wooden theatres did not require those vases). But it is not probable the provinces should possess such magnificent and expensive buildings at a time when Rome itself had but one;

and that deemed so extraordinary, that Pompey was censured for building it, as both Pliny and Tacitus attest. It is more likely the fashion reached not the provinces till long after it had been practised in the capital. Hence it is probable that Vitruvius wrote long after the erection of the theatres of Balbus and Marcellus, and even after stone theatres had become common in the cities of Italy.*

It has been objected that Vitruvius (Book V. Ch. V.) says, *temporary wooden theatres were erected in Rome every year*, and it may be presumed that that would not have been the case after the erection of the permanent theatres of Marcellus and Balbus. But the same argument might be used with regard to the theatre of Pompey, which undoubtedly was built before Vitruvius wrote; also, this author's treating of permanent stone theatres (as before argued), fully evinces that such were in being, notwithstanding wooden ones were frequently erected.

Vitruvius, it is alleged, makes no mention of any edifice that was erected during or after the reign of Augustus. But this is a mistake; for he mentions a temple erected to Augustus himself, one of Julius Cæsar, and other buildings erected in that time; as well as the theatres and amphitheatres already noticed.

In the description which Vitruvius gives of the Basilica which he built at Fano, he says, it was contrived so as not to obstruct the view of the temple of Augustus. This temple then must have been built before Vitruvius began building his Basilica. The Basilica must have been some time in building, and it must have been finished before he wrote his books; yet the emperor to whom he dedicates his books was but just peaceably settled in the government, as the proem to the first book indicates. These circumstances therefore, being compared, will not agree with the supposition, that Augustus was the emperor here addressed by Vitruvius: for it is not to be supposed that a temple was built to Augustus so long (as it must have been) before he was peaceably settled in the government; especially as Augustus did not take that name till the third or fourth year after the battle of Actium. Besides, Vitruvius mentions the name of Augustus without any term of respect, which he scarcely would have omitted if that emperor had been then living: the rather as he held a place of profit and honour by his favour; and as in every other part of his books, where he names the reigning emperor, he speaks with respect, and directs his language to him personally. Farther, history informs us that two temples, and no more, were erected to Augustus in that emperor's life; one of which was at Lyons, and the other at Pergamus in Asia: of this the speech that Tiberius made to the senate, when Spain desired leave to erect a temple to him, is a corroborating evidence.

Tacitus (An. l. iv.) gives this speech thus: "*I know, conscript Fathers, that many will accuse me of inconsistency*

(*) Here it may be observed, if Vitruvius wrote when several stone theatres were in being at Rome, that which he distinguished by the appellation of *the stone theatre*, may not be, as generally supposed, that of Pompey, but more likely that of Marcellus, as being the largest, most considerable, and first entirely built of stone: for that of Pompey must have been partly of wood, from its having been so many times burnt; whereas that of Marcellus was wholly of stone. This suggestion appears the more probable, from the description of stone theatres given by Vitruvius agreeing very

nearly with the construction of the theatre of Marcellus, in all that its present remains allow us to judge of. The degrees of Pompey's theatre may have been of wood, although the substructure and outer walls may have been stone; so that it may have been called a Stone Theatre by the authors of the time, considered in comparison with others which were wholly of wood. This manner of speaking is not unfrequent with authors; for Dio calls the bridge of Trajan over the Danube a stone bridge, although the piers only were of stone, the superstructure being of wood.

for not opposing the same request from the cities of Asia. I will therefore explain the reason of my silence then, and my resolution for the future. The divine Augustus, whose words and actions are to me as so many inviolable laws, having consented that the people of Pergamus should dedicate a temple to him and the city of Rome, I thought I might follow so great an example; so much the rather, as the veneration paid to me was joined with that due to the senate: but as receiving such honour for once may be pardoned; so to be adored in effigy as a god through all the provinces, would appear ambitious and proud, and detract from the honour of Augustus, by making such adoration common.

This speech evidently implies, that Augustus did not permit many temples to be erected to him; for had he done so, as Tiberius refused and condemned the repetition of that honour, it would have been condemning Augustus, whose words and actions he was so emulous to follow, and deviating from those actions, by refusing the honours which Augustus often permitted.

Suetonius (in Augus. l. 52.) says, Augustus permitted no temples to be erected to him in any of the provinces, unless dedicated jointly to him and the city of Rome. Yet Vitruvius ascribes that at Fano to Augustus only; which is as strong an evidence, as history can afford, that it was not erected in his reign.

Should it be alleged that Vitruvius might, from negligence, name Augustus only, although the temple may have been dedicated jointly to him and Rome, it may be answered, that if Augustus thought proper, from motives of delicacy or policy, to permit no temple to be dedicated to himself alone, it is not probable that any author in his time would presume so to express it.

After the death of Augustus, when Numericus Atticus had pretended that he saw his soul ascend to heaven, temples were erected to him. Tacitus (An. i. xi.) says, after his funeral, a temple and religious rites were decreed him; and (l. i. l. 72.) says, that in the time of Tiberius a temple was built to Augustus at Taragon in Spain, which served as an example to all the other provinces. It is therefore probable that it was at this time the temple of Augustus at Fano was built; and, if so, Vitruvius must have written several years after the reign of Augustus.

Vitruvius (Book III. Ch. II.) mentions the temple of Julius Cæsar: and several authors, as Plutarch, Suetonius, Dio, and others, say Augustus erected this temple on that spot in the forum where Cæsar's body was burnt. There is also a medal of Augustus that bears the resemblance of this temple. See Nardini, p. 234.

In the same chapter, Vitruvius mentions the temple of Venus in Cæsar's forum; and this temple, although it was begun, and the foundation of it laid, by Julius Cæsar, is said to have been finished by Augustus. See Hook's Rom. Hist. vol. ii. p. 4.—We find there also mentioned the temple of Ceres at the Circus Maximus: and this

(2*) The three columns in Campo Vacino at Rome are with much probability thought to be the remains of this temple; their intercolumniation being of that species Vitruvius assigns to it: and

they stand opposite the temple of Concord, on the spot where several ancient authors describe the temple of Cæsar to have stood. See Montfaucon's Antiq. vol. ii. ch. 17.

Tacitus (An. l. ii. s. 49.) enumerates with those that were decayed and begun to be restored by Augustus, but dedicated by Tiberius; by whom it must have been finished, since Tacitus says it was only begun by Augustus.

Vitruvius (L. III. C. I.) speaks of the temple of Quirinus as an example of a dipteral temple. Dio Cassius, book 54, says—“*Augustus dedicated that temple in the year of Rome 738, then built anew; and that it had seventy-six columns, exactly the number of years he lived; which caused some to say that it was not by chance but design that he used that number of columns.*” This number of columns will not agree with any but a dipteral temple; for in all the other kinds described by Vitruvius, the number of columns must be many more, or many less: but in the double range around a dipteral temple there are exactly seventy-six columns; so that it is scarcely to be doubted that this temple which Augustus rebuilt, was that to which Vitruvius alludes, and therefore he must have written after that time. Should it be alleged that the old temple of Quirinus (which was in being long before the time of Augustus) may also have been of the dipteral kind, and had the same number of columns, it may be answered, that the new temple must have differed from the old one in that respect; for if Augustus had only copied the old temple, it could not be attributed to him as an act of design, or be accounted ominous, that he used that number of columns. By the foregoing then it appears, that some of the buildings mentioned by Vitruvius were erected by Augustus, or in his time, or afterward; and it is thereby rendered exceedingly improbable that Vitruvius published his book in that reign.

Vitruvius (L. IX. C. III.) names Cicero, whom all the writers of the Augustan age avoided mentioning, lest it should give offence to the emperor, by whom he had been proscribed. Plutarch (in Cicero) says—“*One of the grandsons of Augustus having a book of Cicero's in his hand when his grandfather entered the apartment, endeavoured to conceal it: Augustus however discovering it, took the book; and reading part of it, returned it, saying, That, my child, was a good man, and a friend of his country.*”—This is recorded as an instance of the moderation and temper of Augustus: but it is also an evidence of the public opinion, that the mention of Cicero might be offensive to him; and renders it highly improbable that an author, and an officer dependant on him, should, in a treatise that he professes to write for his use, mention Cicero's name.

In book 55, Dio relates that “*Mæcenas, in the time of Augustus, first introduced the use of hot baths in Rome:*” and in book 53 he says—“*Agrippa first erected at Rome the sudatorium laconicum, so called from being used by the Lacedæmonians.*”—This was in the 9th consulate of Augustus; yet these Vitruvius treats of, and describes as being, and having long been, in common use at Rome when he wrote. It is therefore just to conclude, that he wrote long after this time.

In the proem of the seventh book Vitruvius says—“*Fuffitius was the first among us who wrote on Architecture; then Terentius Varro, in his treatises of New Sciences, wrote one on the same subject, and Publius Septimius two: since which, to this time, no one has written thereof, although there must have been some great architects among the ancient citizens who were able to have written judiciously.*”

These words evidently imply that a considerable number of years had elapsed from the time of Terentius Varro and Septimius to that when Vitruvius wrote this passage, since he speaks of it as extraordinary that no one had written thereof in that interval. Now M. Terentius Varro, the famous author of many books,

lived and wrote in the time of Cicero and Augustus, to the former of whom he addressed some of his books ; and he died in the 7th consulate of Augustus. Had Vitruvius then dedicated his book to Augustus, being old when he wrote, he must have lived and written at the same time as Varro ; and could not, at least, have considered him as an ancient author, nor think it remarkable that no one had written on the subject since his days.^{3*} But let it be alleged, Vitruvius might write some years after the death of Varro, and in the latter part of the reign of Augustus : in answer it may be said, that Vitruvius wrote not to an old emperor, or to one near the close of his reign ; for in the dedication he says, *foreseeing the care thou wilt in future have of public and private edifices*. So that no time in the reign of Augustus, that may be fixed on as the period when Vitruvius published, will be sufficiently distant from the death of Varro, to authorize the mode of expression Vitruvius uses.

The reader is now referred to Note (2) Ch. V. Book VII.

To the foregoing arguments it may be added, that the whole history of the time of Augustus will not agree with the style in which Vitruvius addresses the emperor in the proem to the first book.

He says—“ *When first thou becamest possessed of the empire of the earth ;*” and afterward—“ *When the gods had transferred to thy command the empire of thy father, and had raised him to their immortal seats :*” and also speaks of his governing the senate and people of Rome.

This is language that Augustus, from motives of policy and personal safety, would not, dared not, permit ; of which numerous instances may be collected from every author who has written of that period.

The words imply that the emperor addressed had succeeded his father in the empire immediately upon his death, as a right established by custom ; that he received the government as an inheritance from his father ; that he governed the senate as well as the people ; and that (as may be presumed from the words) the emperor he succeeded had died a natural, not a violent death, like that of Julius Cæsar.

Augustus, upon the assassination of Julius Cæsar, his great uncle, had no prospect of succeeding to his situation in the republic ; his mother Attia, and father-in-law Philip, conjured him not ever to assume the dangerous name of Cæsar (Patercul. ii. 60). Antony had seized the government ; and despising Octavius, as he was then called, on account of his youth, refused him the possession of the property that Cæsar had bequeathed him, and asked him if he thought Cæsar had bequeathed him the empire as well as his name. Octavius commanded an army against Antony in favour of the senate and republic. After this, he and Antony governed conjointly ; and it was owing only to the coincidence of a series of accidental circumstances that he attained the sole authority. When he possessed that authority, he carefully avoided the appearance of it : he formally resigned all his power after the battle of Actium, and would not reassume it otherwise than by the orders and request of the senate ; refusing, even then, the whole of the interior government, which

(3*) Varro lived to a very advanced age, and far in the reign of Augustus. Pliny (l. xxix. c. iv.) speaks of him as publishing in his 88th year ; and (l. vii. c. xxx.) says—Afinius Pollio, who

in the time of Augustus erected the first public library, placed in it the statue of Varro, then living.

remained with the senate : and taking the command of the frontier provinces only, and that but for a term of ten years ; which, when expired, was renewed for ten more, with great appearance of reluctance on his part ; for he knew how odious and insupportable the idea of an absolute governor had ever been to the Romans, and that it had been the cause of Cæsar's death. . When the senate, compelled by the infatuation and superstition of the people, besought him to accept the dictatorship, he absolutely refused it. He was angry if accosted by any title that indicated sovereign authority ; and appeared much offended when an actor in the games styled him Lord, the next day publishing an edict forbidding any one to give him any such title. When he took the name of Augustus, he had a desire rather to assume that of Romulus, declining it only on the fear of its rendering him suspected of aiming at kingly power : and in one of his wills he had advised the senate not to commit the government to any individual. The same system of policy was also observed by Tiberius, who assumed and held the power (as he affected) by the entreaties, and under the authority, of the senate ; not daring to pretend a right to it, as an inheritance left him by his predecessor.

These circumstances appear strong evidences that the language of Vitruvius was not directed to Augustus : the spirit of those times would not admit it ; the empire was not sufficiently settled, and accustomed to a succession of emperors, to authorize such a mode of expression. Nor does any author of that time (as far as I can find) speak of or to Augustus in such a manner, the most general appellation they use being that of Cæsar.

Vitruvius (Book III. Ch. II.) mentions a temple of Equestrian Fortune, as standing at his time near the Stone Theatre in Rome : and Tacitus in his Annals, l. iii. s. 71, says there was no temple so called in Rome at the time of Tiberius's reign he is there recording. He says—*A doubt arose in what temple to place the offering which the Roman knights had vowed to Equestrian Fortune for the recovery of Augusta (Livia) ; for, although many temples of that goddess were in the city, yet none of them had that appellation. A temple, however, was found at Antium that was so called ; and as all ceremonies must, by the laws of the Roman empire, be performed at Italian towns, and temples or statues of the divinities, the offering was placed at Antium.* This appears to be as strong an evidence as can be drawn from history, that Vitruvius must have written after that part of the reign of Tiberius ; for it is clear that the temple of Equestrian Fortune he speaks of must have been erected in Rome after that time.

The reader is now referred to note (8) Ch. VI. Book V. and note (2) Book X. Proem, where the seats or coverings on the stone degrees of the theatre are mentioned, and which carries the time of Vitruvius beyond that of Caligula.

It may be farther remarked on this passage, that the mention of coverings of seats being laid on the degrees, makes it almost certain that there was some theatre in Rome in which the degrees were of stone, and which it was the practice to cover, when Vitruvius wrote ; and it is also equally probable that the degrees of Pompey's theatre must have been of wood, from being so many times consumed by fire, as before argued. This strengthens the opinion that he wrote after the erection of the theatres of Marcellus and Balbus, in the time of Augustus.^{4*}

(4*) In the account the Marquis de Venuti gives of the discovery of Herculaneum, he says, upon being let down into the theatre, he observed the degrees to be covered with wood, appearing like a great wooden staircase —An inscription still remaining over the orchestra door of this theatre, records P. Numisius as the architect.

It is not improbable that it may have been the colleague of Vitruvius mentioned in his first proem ; and whose name the copyists have written P. Numidius, and sometimes Numidicus, or Minidius ; all which variations may have arisen from the incorrect formation of the letters in the old manuscripts.

Some circumstances in the reign of Nero seemed to argue that Vitruvius had written therein, or prior thereto. Nero, after the conflagration of Rome in his time, prohibited common or party walls, ordering each house to be inclosed with its own wall (Tacit. An. l. xv.). But Vitruvius (l. ii. c. viii. and l. vi. c. ix.) speaks of such party walls as being in use when he wrote: he also speaks of, and describes, timber walls (allowing the expression), which it may be presumed Nero would, from similar motives, have forbidden; for he ordered the houses to be rebuilt to a certain height without any timber, and with Alban and Gabian stone, which fire could not damage. From these circumstances it might be presumed that Vitruvius wrote before these prohibitions were made. But Pliny (l. xxxv. c. xiv.) speaks both of party and timber walls, in the same manner: and yet he certainly wrote after Nero's death; for he mentions him as being deceased in several preceding parts of his book. It may therefore be concluded that Nero's regulations did not remain in force.

Again—Tacitus numbers the temple of Jupiter Stator vowed by Romulus, and built by the consuls P. Metellus and Att. Regulus, among the buildings that were burnt in this conflagration: and Vitruvius (l. iii. c. i.) mentions a temple of this name as an example; but he says it was *IN* (which may signify *AT* or *NEAR*) the portico of Metellus. Now this portico was near the Circus Flaminius, where the fire did not reach; whereas the temple of Jupiter Stator, vowed by Romulus, was near the Forum, and mount Palatine, where the fire raged, and was within the bounds of the original city of Romulus. Varro, as quoted by Macrobius (Saturnal. l. iii. c. iv.) mentions a temple of Jupiter Stator at the Circus Flaminius; and Pliny also (xxxiv. vi.) speaks of a temple of this name, and of the portico of Metellus, as in being when he wrote: hence it follows that the temple mentioned by Vitruvius was probably not that which Tacitus says was destroyed by the fire in Nero's reign; and therefore the argument will not apply. In the short and tumultuous reigns of Galba, Otho, and Vitellius, it is not probable that Vitruvius published his work: nor can it be supposed that he wrote to Vespasian; for circumstances will not agree. Vitruvius, in his first proem, mentions the sister of the emperor whom he addresses, and Vespasian had no sister.

The reign of Titus followed next; and no circumstance that I have met with, or can recollect, opposes the supposition of his being the emperor to whom Vitruvius dedicated his work: on the contrary, many circumstances seem to agree therewith; and it is confirmed by others that render it probable that it was to no succeeding emperor.

The first eruption of mount Vesuvius upon record happened in the last year of the reign of Titus. So wonderful a phenomenon could not be unknown to any author who wrote after that event. But Vitruvius (l. iii. c. vi.) says *there was a tradition that such an event had happened in former times*: a sufficient indication that he knew of no such for certainty, and consequently that it had not happened when he wrote the passage.

The portico of Metellus, just before mentioned, Vitruvius speaks of as in being. Paterculus, who wrote in the reign of Tiberius, says (l. i. c. xi.) *this portico was surrounded by that of Octavia*; and Dio (l. lxvi.) relates that *all the buildings of Octavia were destroyed by a fire that happened in the reign of Titus*; from whence it is probable Vitruvius wrote before that fire happened. It is true, Titus is said to have restored these buildings; but this could scarcely be done completely within his short reign: it is related that he did not live to finish all the works he had begun, but that they were finished by Domitian. Even had they been com-

pleted by Titus, the time from thence to the conclusion of the reign cannot be supposed sufficient for the composition of Vitruvius's book, or the part of it from that passage to the end.

The above circumstances render it probable that Vitruvius published his work in the reign of Titus: but he had probably been writing and composing it for several years prior to its publication; for he says *it had cost him much study, and he was old and infirm when he published it. As he was also engaged in the occupation of an engineer in the army*, it cannot be supposed that he could compose so large a work in a few years, or during the short reign of Titus; but most likely wrote it at different times, and in the intervals of leisure that his profession allowed him. This the following remarks will also contribute to render probable.

Vitruvius (book viii. chap. iv.) speaking of the properties of a spring near Ismuc in Africa, says *he had the account from C. Julius, the son of Masinissa, to whom the lands of the town belonged; who was in the army with Cæsar the father, and used to be his (Vitruvius's) guest. "C. Julius, Masinissæ filius, cujus erant totius oppidi agrorum possessiones, cum patre Cæsare militavit, is hospitio meo est usus."*—"Cum patre Cæsare," *with the father Cæsar*, is an extraordinary expression, and seems to relate to a time when there were two Cæsars, father and son, reigning together: this was the case with Vespasian and Titus; they reigned jointly. Pliny frequently speaks of them in that light (see book iii. ch. v. and Suet. in Tit. vi.); and the words are perfectly proper, in such a case, to distinguish the father from the son Cæsar. C. Julius, by his father's name, and his possessions in that country, was probably an African; and joined this father Cæsar, whoever he may have been, in that country. Now it is known that Vespasian commanded in Africa, of which province he had the government before he came to the empire; and there he married his wife Domitilla, an African lady. Vitruvius was an engineer; he therefore may have been also there, in Vespasian's army.

It appears, by the proem to the first book, that Vitruvius had been known to this father Cæsar and his family, as he must have been to the general in whose army he served as an engineer. All these circumstances therefore agree well with the supposition, that Vitruvius wrote this passage in the time of Vespasian, although he might not publish his work till the time when Titus reigned alone; and that Vespasian was the emperor Vitruvius alludes to by the words *cum patre Cæsare*.^{5*} Some have thought the words *cum patre Cæsare* referred to Julius Cæsar; but *divo Cæsare* would in that case have been properly used, as at book iii. chap. ii. for Cæsar was deified. Galiani however, under that idea, has endeavoured to ascertain who C. Julius and Masinissa were, and the time they lived, in order to fix that of Vitruvius. He gives up the idea of Masinissa being the famous African king of that name who joined with Scipio, as having been dead too long before the time of Augustus to suppose he could have had a son in the army at that time; as also of *Julius* being written instead of *Juba*; and then suggests an alteration of the text, of *Masintha* for *Masinissa*, because one of that name is mentioned by Suetonius in Julius Cæsar's life: but all the copies have *Masinissa*, and there is no ground for the alteration.

(5*) The dedication, or first proem, as it is named, was probably written at the time of publication, although other parts of the book may have been written before. It appears to be erroneously called the proem: as that which has been marked the first chapter seems rather to have been intended as the proem of the first book;

it consisting of introductory matter, like those of the other books. In some other parts of the work also, what appears to have been intended by Vitruvius as part of the proem of a book, has been separated by the copyists, and divided into chapters. See the first three chapters of the ninth book.

The circumstances mentioned of C. Julius having possessions about the town of Ismuc, and his being the guest of Vitruvius (in whatever way that may be understood) in his house or his tent, argue that he was not the son of a king, but rather a private man of that country.

It has before been remarked that Vitruvius was well acquainted with the buildings of Greece and Asia, and had therefore probably been a traveller in those countries. But, when his profession is recollected, this is accounted for : being an engineer, he of course accompanied the army into different countries. If he was with Vespasian in Africa, it is not unlikely that he also attended him when sent to command in Greece and the Eastern countries, where Vespasian was when elected to the empire : Vitruvius might therefore have at that time seen and become acquainted with the Grecian edifices. This supposition at least agrees with all the other arguments here advanced ; and it accounts for that acquaintance he claims in his dedication with the father of the emperor he addresses.

I am here obliged to take notice of a circumstance mentioned by Galiani, in the life of Vitruvius prefixed to his translation. He says that *Vitruvius is not known to be mentioned by any classic author except Pliny, who names him in his catalogue of antient writers ; and by Frontinus, who mentions him as the author of the Quinarian Module, at the same time saying that Augustus introduced that module.*

The fact is, Pliny nowhere mentions Vitruvius, as I can find : the catalogue of ancient authors annexed to his history was not made by himself ; but, as his commentator Hardouin observes, by some copyist, who names Vitruvius in that catalogue of his own authority ; believing that Pliny copied Vitruvius in some passages in which they both write similarly. I may, for the same reason, suppose that Vitruvius copied Pliny. The latter generally names the author from whom he copies, and in his address to Titus professes so to do ; yet he has, in several passages, used almost the same words as Vitruvius has written, without mentioning him : it is therefore a presumptive evidence that he did not copy from him, and consequently that Vitruvius did not publish his work prior to Pliny's time of writing.

Frontinus, it is true, does mention Vitruvius ; saying, *some supposed him, and some Agrippa, to be the author of the Quinarian Module* : but he does not say that it was introduced by Augustus, or in his time.

Frontinus wrote in the reign of Trajan, between whom and Titus were only Domitian and Nerva : his naming Vitruvius, therefore, adds to the probability that the time of Vitruvius could not be later than that of Titus.

On the foregoing arguments readers will form their own judgment : it may be thought a point of no great importance. The ascertainment of it, however, may not be entirely useless ; as numerous conclusions are and have been drawn from the presumption of the time of Vitruvius being coincident with that of Augustus, which, with all their consequences, will be erroneous, should not that be the fact ; and this has induced me to bestow some attention on the discussion.

(6*) The table of contents of the books of Pliny is defective in all the manuscripts : it cannot be that compiled by Pliny ; because it is divided into chapters, a mode of division the antients never used. Pliny, in his dedication to Titus, says that *he had subjoined the contents of the several books* : he also mentions the number of books to be thirty-six ; but the copyists, numbering the table of

contents made by themselves as the first book, have made the whole work to consist of thirty-seven. In this table the name of Vitruvius is inserted with those of other authors ; but it is not to be found in the text of Pliny, at any of those places to which the reference is made, nor in any of the thirty-six books of Pliny.

C O N T E N T S.

BOOK THE FIRST.

	Page
PROEM - - - - -	1
C H A P. I.	
Of Architecture, and the Instruction of Architects	2
C H A P. II.	
Of what Architecture consists - - - - -	7
C H A P. III.	
Of the Parts and Principles of Architecture -	10
C H A P. IV.	
Of the Choice of healthy Situations - - - -	11
C H A P. V.	
Of the Construction of the Walls and Towers -	13
C H A P. VI.	
Of the Division and Disposition of the Works within the Walls - - - - -	15
C H A P. VII.	
Of the Situation of the Public Buildings - -	19

BOOK THE SECOND.

PROEM - - - - -	21
C H A P. I.	
Of the Original of Buildings - - - - -	23
C H A P. II.	
Of the Principles of Things, according to the Opinion of Philosophers - - - - -	25
C H A P. III.	
Of Bricks - - - - -	26
C H A P. IV.	
Of Sand - - - - -	27
C H A P. V.	
Of Lime - - - - -	28
C H A P. VI.	
Of the Earth of Pozzuoli - - - - -	29
C H A P. VII.	
Of Stone Quarries - - - - -	30
C H A P. VIII.	
Of the several Sorts of Walls - - - - -	32
C H A P. IX.	
Of Timber - - - - -	37
C H A P. X.	
Of the Firs called Supernas and Infernas -	41

BOOK THE THIRD.

PROEM - - - - -	43
C H A P. I.	
Of the Composition and Symmetry of Temples	45
C H A P. II.	
Of the five Species of Temples - - - - -	50
C H A P. III.	
Of the Foundations, and of the Columns and their Ornaments - - - - -	54

BOOK THE FOURTH.

	Page
PROEM - - - - -	67
C H A P. I.	
Of the three Kinds of Columns, and of their Invention - - - - -	68
C H A P. II.	
Of the Ornaments of Columns - - - - -	71
C H A P. III.	
Of the Doric Order - - - - -	73
C H A P. IV.	
Of the internal Distribution of the Cell and Pronaos - - - - -	79
C H A P. V.	
Of the Position of Temples according to the Regions - - - - -	80
C H A P. VI.	
Of the Proportions of the Portals of Temples	81
C H A P. VII.	
Of the Proportions of Tuscan Temples - -	86
C H A P. VIII.	
Of the Altars of the Gods - - - - -	90

BOOK THE FIFTH.

PROEM - - - - -	91
C H A P. I.	
Of the Forum - - - - -	94
C H A P. II.	
Of the Treasury, Prison, and Curiae - - -	96
C H A P. III.	
Of the Theatre, and its Situation - - - -	97
C H A P. IV.	
Of Harmony - - - - -	99
C H A P. V.	
Of the Vases of Theatres - - - - -	102
C H A P. VI.	
Of the Form of Theatres - - - - -	104
C H A P. VII.	
Of the Porticus, and other Parts of the Theatre	106
C H A P. VIII.	
Of the three Kinds of Scenes, and the Theatres of the Greeks - - - - -	107
C H A P. IX.	
Of the Porticos behind the Scenes, and of Ambulatories - - - - -	113
C H A P. X.	
Of the Disposition and Parts of Baths - -	115
C H A P. XI.	
Of the Construction of Palestre - - - -	118
C H A P. XII.	
Of Ports, and Structures built in the Water -	120

E R R A T A.

IN THE PREFACE.

Page	line	
v	14	for Vitruviani, <i>read</i> Vitruvianæ
	22	— Euriditi, <i>read</i> Erudit ^m . (or Eruditorum)
vi	31	— engravings, <i>read</i> engravings

IN THE OBSERVATIONS, &c.

viii	34	— agree, <i>read</i> agrees
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IN THE TEXT AND NOTES.

3	36	— of unison, <i>read</i> of the hemitones
8	5	— the holes of, <i>read</i> the modular holes of
	13	— Hercules, <i>read</i> and Hercules
15	38	— was, <i>read</i> were
18	3	— apricus, <i>read</i> aphricus
19	14	— tutular, <i>read</i> tutelar
	32	— observe, <i>read</i> remark
23	32	— oak shingles, <i>read</i> oaken shingles
28	1	— lays, <i>read</i> lies
	13	— burnt, <i>read</i> quenched
	35	— and lime made of flint-stones, <i>read</i> lime and flint-stones. N. B. The remainder of this <i>Note</i> to be expunged.
31	30	— laying, <i>read</i> lying
36	12	— whereas, <i>read</i> when
	13	— may be, <i>read</i> are to be.—Ib. for a great age, <i>read</i> a great age, they should be done thus
	20	— laid, <i>read</i> lain
	25	— hurdle, <i>read</i> timber
37	3	— left perpendicularly and transversely, <i>read</i> caused by the perpendicular and transverse timbers
	7	— hurdles, <i>read</i> timbers
43	15	— lays, <i>read</i> lies
46	41	— suppositions, <i>read</i> supposititious
48	4	— also two columns, <i>read</i> also columns
	23	— empreffion, <i>read</i> expreffion
49	12	— peristyle of a portico, <i>read</i> portico of peristyles
50	31	— XXV. <i>read</i> XXVI.
55	8	— (o) <i>read</i> (q)
56	7	— scamillos, <i>read</i> scamilli
57	21	— adjections are found between, <i>read</i> adjections between
	36	— correspond to suit the level, <i>read</i> correspond to the level
	37	— correspondence alluded to between, <i>read</i> correspondence between
58	25	— the cymatium, <i>read</i> the cymatium (G),
59	3	— extremity of the cymatium (n), <i>read</i> the extremity (n) of the cymatium
62	7	— the (shaft of the column), <i>read</i> the shaft (of the column)
	44	— the projection of the cymatium, <i>read</i> the projection of the epistylum
	60	— does not here mean, <i>read</i> does not there mean
72	45	— a and b, <i>read</i> a and d
74	18	— is, <i>read</i> are
	22	— is, <i>read</i> are
75	40	— is always found, <i>read</i> is often found
76	41	— as the projecture, <i>read</i> as the thickness
77	50	— collocendi, <i>read</i> collocandi
	51	— accedat, <i>read</i> accedet
	72	— quatur, <i>read</i> quatuor
78	43	— as even the small draught, Fig. XVI. evinces—to be erased
81	5	— behold it, <i>read</i> behold them
	44	— pronanos, <i>read</i> pronaos
82	22	— pronanos, <i>read</i> pronaos
	73	— supposed, <i>read</i> suppressed
83	4	— Lesbiam, astragal, <i>read</i> Lesbian, astragal
88	12	— walls, is equal, <i>read</i> walls and path around, is equal
	73	— has mentioned, <i>read</i> has not mentioned
89	49	— pseudo-dipteral, <i>read</i> pseudo-peripteral
95	14	— prodium, <i>read</i> podium
96	11	— Fig. XXV. <i>read</i> Fig. XXXV.
106	44	— determinate, <i>read</i> indeterminate
116	15	— to be the apartment containing the vessels, <i>read</i> to be the vessels
	64	— 3*, <i>read</i> 8*
	69	— cadariæ, <i>read</i> caldariæ
117	3	— the floors, if, <i>read</i> the cielings, if
	5	— for the causeway, <i>read</i> for the pulvinus
118	38	— labrumor, <i>read</i> labrum or
	53	— proves, <i>read</i> prove
119	11	— propingium, <i>read</i> propnigium
120	25	— terras, <i>read</i> tarras
121	20	— inclined side; it is filled, <i>read</i> inclined side it is filled
122	7	— the joints, <i>read</i> the bond joints

T H E
A R C H I T E C T U R E

O F

M · VITRUVIUS · POLLIO.

B O O K T H E F I R S T.

P R O E M.

WHEN thy divine mind and genius, O Emperor Cæsar,^{1*} first became possessed of the empire of the earth, and thou hadst with invincible valour, subdued all thy enemies; thy citizens gloried in thy triumph and victory; all nations subjected, attended thy command; and the people and senate of Rome, delivered from fear, were governed by thy superior wisdom and judgment. I presumed not then, when thou wert so much engaged, to publish this treatise of Architecture, which I have with great study composed; fearing to incur thy displeasure, by the unfitness of the time: But now, seeing thee attentive, not only to public affairs, and the general security of the state, but also to the convenience of public edifices, (for by thee, Rome, the seat of the empire, has been adorned with public buildings, as well as enriched with provinces) I judged it right to delay no longer presenting to thee these things; the rather, because, being known to thy father, and admiring his virtues, when the celestial council of the Gods, had raised him to their immortal seats, and transferred to thy command, the empire of thy father, the veneration which I retained for his memory, procured me thy favour; wherefore, with M. Aurelius, P. Numidius, and C. Cornelius, I was appointed to the care and reparation of the balistas, scorpions, and other military engines, and with them receive the reward. This thou didst first confer on me, in consequence of thy sister's commendation. Being therefore so greatly indebted to thy beneficence, and to the end of my life freed from the fear of want; I began to write for thee this treatise, having observed how much thou hast built, and art now building; and foreseeing the care thou wilt have in future of public and private edifices, that the memory of thy great achievements may descend to posterity. I have written these precepts with precision, that by their help, thou mayest judge of the works already done, or that shall be done hereafter; for in these books I have revealed all the principles of the art.

(1*) Which of the Roman emperors it was, whom Vitruvius here addresses, is a point not settled. See the Remarks on the Life of Vitruvius, prefixed.

C H A P T E R I.

Of Architecture, and of the Instruction of Architects.

ARCHITECTURE is an art comprehending many sciences and various kinds of erudition; by the rules of which, the works of all other arts are examined. It consists of practice and theory.^{1*} Practice is the constant and accustomed attention to the manual operations, and to the several kinds of materials of which a work may be constructed. Theory is the ability to demonstrate and explain the rules and reasons of the proportions of buildings. Architects who have practised without theory, and who have been only experienced in the manual part, have not been able to acquire any reputation by their works; and those who have trusted to theory and speculation only, have followed the shadow and not the substance; but those, who are perfectly acquainted with both, like men completely armed, speedily, and with reputation, succeed in their endeavours; for as in all things, so especially in architecture, there are two parts, the signified and the signifier; the former is that which is here proposed to be treated of; the latter is the demonstration of the principles of the sciences explained; and he who professes architecture, ought to be well exercised in both parts. He should be ingenious, and docile of instruction; for neither ingenuity, without education, or education, without ingenuity, can render him a complete artist. He ought to have a knowledge of letters, be expert in drawing, learned in geometry, not ignorant of optics, instructed in arithmetic, well read in history, to have diligently attended to philosophy, to have a knowledge of music, not a stranger to physic, understanding in the law, and be conversant in astronomy and the aspects of the heavens; why these are necessary, the following are the reasons.

AN architect should have a knowledge of letters, that he may be able to insure the remembrance of his observations. By drawing, he is enabled to form the representation of the work he would execute. Geometry is of great use to architecture, and teaches the use of the ruler and compass (which chiefly facilitates the delineation of the plans of buildings) and the management of squares, levels, and lines. By optics is ascertained the region of the heavens, from whence buildings should receive their light. By arithmetic, the expence of the edifice is calculated, the measures adjusted, and the difficult questions of the symmetry solved. Architects should be well acquainted with history, for they often introduce many ornaments in their works, whose original they should be able to recite; as, for example, if

(1*) The words of the text are *Fabrica & Ratiocinatione*, which most of the translators have agreed in rendering practice and theory: but the definitions of Vitruvius, give us to understand, that by practice, he does not mean the actual labour of the workmanship, but the knowledge thereof only, so as to be able to direct the workmen, and

to know when the work is well performed, and the materials good; as by theory he means the knowledge of the proportions, forms, distributions, &c. of the several parts of buildings, and their effects, so as to be able to design or compose with judgment.

marble statues of women in garments, which are called Caryatides, should be introduced in a building, supporting the mutules and cornice, instead of columns; when the reason is demanded, it may thus be given. Caryæ, a city of Peloponnesus, having joined with the Persians against the Grecian states, and the Greeks having put an end to the war by a glorious victory, with one consent declared war against the Caryatides. They took the city, destroyed it, slew the men, and led the matrons into captivity, not permitting them to wear the habits and ornaments of their sex: and they were not once only led in triumph, but were loaded with scorn, and kept in continual servitude, thus suffering for the crime of their city. The architects therefore of those days, introduced their effigies sustaining weights, in the public buildings, that the remembrance of the crime of the Caryatides might be transmitted to posterity. The Lacedæmonians, likewise, under the command of Pausanias the son of Cleombrotus, having, at the battle of Platea, with a small number vanquished a numerous army of Persians, to solemnise the triumph, erected, with the spoils and plunder, the Persian portico, as a trophy to transmit to posterity the valour and honour of the citizens; introducing therein the statues of the captives adorned with habits in the barbarian manner, supporting the roof. Thus with merited infamy they punished pride, terrified their enemies with the idea of their power, and the citizens beholding this monument of their courage, were inspired with a love of glory, and became more animated in the defence of their liberty. Hence it is that many introduce Persian statues sustaining the epistylum^{2*} and its ornaments, and thus make an excellent variety in their works. There are also other similar historical facts, with which it behoves an architect to be well acquainted.

PHILOSOPHY enlarges the mind of an architect, frees him from arrogance, and renders him courteous, just, and faithful. Avarice he should particularly avoid, for no work can succeed without fidelity and integrity. He should never be covetous, or have his mind intent on receiving of gifts, but with prudence support his proper dignity and reputation. All this philosophy inculcates; it also teaches the nature of things, which the Greeks call *physiologia*, and which ought to be well understood, for many and various natural questions are solved thereby; as, for example, by the courses, turnings, and different levels of the water in aqueducts, the natural spirits are excited, the ill effects of which, none can prevent, but those who by the study of philosophy have learnt the principles and nature of things. Also whoever would read the books of Ctesibius, Archimedes, or others who have written on such kind of subjects, will not be able to understand them, unless he has been previously instructed in philosophy. An architect ought to understand music, that he may know the canonical^{3*} and mathematical rules of the proportions, and that he may properly regulate the force of the balistas, catapultas, and scorpions; for on either side of their little capitals, are the holes of ~~unison~~^{unison}, through which, with the capstans or levers, the sinewy cords are strained, and not stopped, or fastened, till the engineers perceive all their sounds are alike; for when the

(2*) Epistylum is a term sometimes used to signify the whole entablature, as in this place, and at the 11th note of the following chapter, but it more generally signifies the architrave only. Among the other remains of antiquity at

Athens, an example of the order of the Caryatides is still subsisting.

(3*) Canonical, alludes to a certain rule or scale, by which the ancients used to regulate the musical intervals.

arms, which are held by these cords, are both equally strained, they give the stroke properly; but if the cords are not in unison, the projectiles will vary, from their intended direction: so also the brazen vases in the little cells under the seats of the theatres, are disposed by mathematical rules, and the distinctions of their tones, which the Greeks call *Eccheid*, are regulated by musical concord and proportion, divided in the compass of diatessaron, diapente, and diapason.^{4*} So that the sound of the voice from the stage, striking the correspondent vase, resounds, and becomes stronger, clearer, and more melodious, in the hearing of the audience: neither can the hydraulic organs,^{5*} and other similar machines, be constructed without the knowledge of music.^{6*}

THE study of physic is necessary, to be able to understand the nature of climates, which the Greeks call *Climata*, and whether the air and water of places are wholesome or noxious, for without good air and water no habitation can be healthy.

It is requisite to have a knowledge of the laws, which are necessary for the regulation of the walls of public buildings.^{7*} The gutters of the eaves, the shores, lights, water channels, and so forth, with which an architect should be well acquainted, in order that he may be careful at the beginning of the building, not to leave the father of the family involved in controversies after the work is finished; and that the conditions be written with caution and equity, both with regard to the employer and the artificer; for when the conditions are justly described, both parties will remain free from altercation. By astronomy, is known the situation of the east, west, south, and north, the motions of the heavens, the equinoctial,

(4*) The musical intervals, called the fourth, fifth, and octave.

(5*) According to Tacitus and Suetonius, these organs were first known at Rome in the reign of Nero. See the Observations on the Life of Vitruvius, prefixed.

(6*) Galiani, in his notes on this passage, imputes the degeneracy of modern architecture, to the modern architects (in general) being so ignorant of music; and observes how greatly the ancients attended to it in proportioning their buildings, as may be inferred from the remains of their works; instancing in particular the sepulchre of the servants of Augustus, as published by Bianchini, who shews how perfectly its proportions agree with those of music.

Palladio, Alberti, and many others who have written on architecture, agree in the same opinion, and prescribe the application of the musical proportions to works of architecture.

There is great reason to believe, that the same proportions which are so pleasing to the ear, will also please the eye, when applied to visible objects. For nature acts by the easiest and simplest means, and never varies the cause to produce the same effect, when the same cause will answer the end. In colours, nature uses the same cause, and the same effect arises; their harmony consisting in the same proportions as prevail in musical tones; why not therefore, in figures, in which case, the perceiver, the proportions perceived, and the sense conveying those proportions to the

mind, are the same; and the only difference between this and the case of the musical tones is, that the sensation of the proportions are conveyed to the perceiver by another conductor, (i. e.) another sense? It may not therefore be wholly without reason to suppose, that the same proportions will have the same effect on either sense, the eye, as well as the ear; in figures, as well as in sounds and colours.

It may be observed, that the musical concords are most pleasing and harmonious comparatively, as their proportions are the simplest, composed of the lowest numbers, and easiest to be distinguished; as, for example, the octave, which is, as one is to two, is a more perfect concord than the fifth, which is as two to three; and that last is more perfect than the fourth, which is, as three to four, &c. This observation then may serve as a hint to induce us (in case of using the musical proportions in architecture, or in any regular objects) to prefer the simplest that will serve the purpose. See Note 6, Chap. I. Book II.

(7*) Galiani has observed, that the word *communis* should be understood to signify exterior, and offers as proofs the places, where the same word is again mentioned; viz. at Chapter VIII. Book II. and Chapter IX. Book VI. I however cannot help understanding it differently, even in those very places he quotes, and believe that the word *communis* is intended to signify common, or public. See the Notes at those places,

the solstices, and the order of the stars, without which knowledge, the art of dialling cannot be understood.

THIS art, therefore, being so extensive, and enriched with so many various sciences, I think none can on a sudden justly profess themselves architects, nor unless from their youth they have gradually surmounted these studies, been nursed in the knowledge of the many arts and sciences, and thus have arrived at the perfect knowledge of architecture. Perhaps illiterate men may wonder how so many sciences can be acquired and retained in the memory; but when it is considered that all the sciences have a mutual connexion and communication, it will be more easily credited; for the whole circle of arts is as one body, composed of divers members; and those who from their youth, are instructed in all the different arts, observe in them all an analogy and similarity of principles, and find they are easily acquired. Hence the ancient architect Pythius, who erected the magnificent temple of Minerva, at Prienæ, says in his Commentaries, that an architect ought to excel in all arts and learning, those who by their industry and practice, have brought things to their greatest perfection. But that cannot be necessary; for an architect neither need be, nor can be, so good a grammarian as Aristarchus, though he must not be illiterate; nor a musician like Aristoxenus, though not ignorant of music; nor a painter like Apelles, though not unskilful in drawing; nor a statuary like Miron, or Polycletus, though not a stranger to sculpture; nor as learned in physic as Hyppocrates, though not unacquainted with that art; nor need he be singularly excellent in any of the other sciences, though he should not be entirely without their knowledge; for in such a number of different things, it is not possible to attain to singular perfection in each. It is scarcely in our power to conceive and understand their principles; nor is it architects alone who cannot arrive at this pitch of eminence in all literature; for even some of those who have professed a single art, have not been able to obtain the highest degree of reputation. If, therefore, of all those artists who practise only one art, very few, in an age, become remarkably excellent, how can it be expected that an architect, who ought to be skilled in many sciences, should exceed, or even equal, those artists, who with great assiduity and industry have applied themselves to a single art?

In this, therefore, Pythius seems to have been mistaken; not considering that every art consists of two parts, the practice, and the theory; of these, one is peculiar to those who exercise each particular art, viz. the practice; the other, which is the theory, is common to all the learned. So the pulsation of the veins, and the movement of the feet, are common to the professors of both physic and music; but if a wound is to be healed, or a dangerous malady cured, a musician is not employed, for it is the peculiar practice of a physician; and on the contrary, the musician, and not the physician, must modulate instruments of music, so that our ears may be delighted with their sounds. Between astronomy and music, there is likewise a common reasoning, upon the sympathy and symphony of the stars, in quadrate and trine, diatessaron and diapente. In optics, by the Greeks called *logos opticos*, and in all other sciences, there are many things similar, or which have, at least, the same common principles. But as to the executive part, in which practice and experience leads to perfection, it belongs to those who are devoted to the exercise of one particular art. It is

therefore sufficient for an architect to have a moderate knowledge of the parts and principles of the several arts which are assistant to the practice of architecture, that, if he should have occasion to judge of those arts, or to examine a performance, he may not be found ignorant or deficient. Some there are to whom nature has given so much sagacity, penetration, and memory, that they are able to acquire a complete knowledge of geometry, astronomy, music, and many other sciences; these exceed the department of architects, and become mathematicians. Being therefore furnished with so much knowledge, they can with facility discourse on many subjects; but even among these there rarely happens to be such men as Aristarchus of Samos; Philolaus, and Architas, the Tarentines; Apollonius of Pergeus; Eratosthenes of Cyreneus; Archimedes and Scopinas of Syracuse; who have left to posterity many mechanical and gnomonical inventions, which, by their knowledge of numbers, and the laws of nature, they have discovered and explained.

As therefore such talents and natural abilities are not granted to all men, but to very few, and as the profession of an architect requires that he should be acquainted with all erudition, though, on account of the extensiveness of science, it is admitted that a perfect knowledge of all is not to be expected, and that a moderate degree is sufficient, I request indulgence from thee, O Cæsar, and those who read my books, if any thing should not be here described according to the strict rules of grammar, for I pretend not to write like an eminent philosopher, an eloquent rhetorician, or excellent grammarian practised in the principles of the art; but as an architect, moderately acquainted with letters. So far, therefore, as the art and the rules thereof will admit, I promise, (as I hope) that these books will be written to the satisfaction, not only of professors, but of the learned in general.

C H A P T E R II.

Of what Architecture consists.

ARCHITECTURE consists of Ordination, which the Greeks call *taxis*; of Disposition, which the Greeks call *diathesis*; of Eurithmy, Symmetry, Decor, and Distribution, which the Greeks call *oiconomia*. Ordination^{1*} is the proper modification of the members of the work, separately, and the regulation of the whole proportion and symmetry. This arises from quantity, which the Greeks call *posotes*. Quantity relates to the measures used in the same work, and the suitable effect of the several members, and of the whole building. Disposition^{2*} is the apt collocation of the parts, producing the proper qualities in the composition of the work; the kinds of disposition, by the Greeks called *ideai*, are these, Ichnography^{3*}, Orthography^{4*}, and Scenography^{5*}. Ichnography is the use of the compasses and ruler, in describing the horizontal figures of objects. Orthography is the delineation of the front, according to the true measures of the intended work. Scenography is also the representation of the front, with the side receding in shadow, and all the lines tending to a central point. These arise from cogitation and invention. Cogitation is profound reflection, joined with industry and vigilance, delighting to produce the desired effect. Invention is the solution of intricate questions, and the discovery of novelties. These are the limits of disposition.

^{6*} EURITHMY consists in the beautiful form and handsome appearance of the members of a composition. This is effected when the heights of the members are adapted to their breadth, and their breadth to their length, each being correspondent to the symmetry

(1*) All the commentators of Vitruvius allow this explanation of architecture to be very dark and unintelligible; and all differ in their interpretation thereof; its obscurity may very likely be owing, in a great degree, to our ignorance of many circumstances of those times, their use of the technical terms, or the different acceptation of words. The words are here put together in such a manner, as seem to us to have no coherence or sense; we can, therefore, do no more than make conjectures concerning their true meaning, guided by the little assistance they will afford us.

Ordination I suppose to be used in the sense we now use the word order; it expresses the kind of composition employed in the building, as the Doric kind, the Ionic, or Corinthian kinds, &c. It may be said to relate to quantity, because the order governs the proportional magnitude of the parts; for, according to the kind or order of building used, the parts are varied in their proportional magnitude.

(2*) Disposition here seems to be used by Vitruvius, in the sense of composition; he mentions this latter word in his definition. Disposition, in the sense we generally accept it, is included in the article of Distribution, hereafter defined.

(3*) The art of drawing the geometrical plans of objects.

(4*) That of drawing their geometrical elevations.

(5*) The art of drawing their perspective appearances.

(6*) Eurithmy, by the description of Vitruvius, answers to proportion, which is the harmonious correspondence of the height, breadth, and length of objects, and the agreement of the parts with each other, and with the whole.

of the whole. Symmetry^{7*} is also the proper agreement of the same members of a work, and the proportional correspondence of the separate parts to the form of the whole object; as in the human body, the arm, the foot, the palm, the finger, and the other members are in symmetry. And so it must be in all perfect works, but particularly in sacred edifices; as in the thickness of the columns, the order of the triglyphs, the holes of the ballistæ, which the Greeks call *peritreton*, or the interscalmii^{8*} of galleys, called *dipechaice*, and in similar works; in all which, the members are regulated by the rules of symmetry.

DECOR^{9*} consists in the proper appearance of a work, and its being compounded of approved and authorised parts. This has regard, either to station,^{10*} which the Greeks call *thematismos*, custom; or nature. To station, when temples which are erected to Jove the thunderer, the heavens, the sun, or the moon, are built uncovered, and exposed to the air, because the influences and effects of those deities are perceived in the open air; when to Minerva, Mars, Hercules, Doric temples are built; for on account of the attributes of these deities, edifices constructed without delicacy are most suitable. To Venus, Flora, Proserpine, and the nymphs of the fountains, the corinthian kind are erected with propriety; for by reason of the delicacy of those goddesses, the graceful, gay manner, with foliage, and ornamented volutes, give a due decorum to the work. To Juno, Diana, Bacchus, and such other deities, Ionic temples are constructed, as possessing the mediocrity; for being tempered of the severity of the Doric, and the tenderness of the Corinthian, they become most suitable. Decor, with regard to custom, is observed when the internal parts of edifices being magnificent, the accesses are also made suitable and elegant; for if the interior parts are elegant, and the approaches are mean and ignoble, it will not have decor. So likewise if dentils are carved in the cornice of the Doric epistylum^{11*}, or in the abacus of the capital, or if triglyphs are represented in the epistylum of Ionic columns, transferring the characteristics of one kind of work to another; it offends the eye, because custom has established a different order of things. Decor, with regard to nature, consists in all temples being placed in a salutary situation, with fountains of water in the places where the fane is built; but especially, the temples of Esculapius, of Health, and such deities, by whose healing influence numbers of sick appear to be recovered. For the diseased bodies being removed from an unhealthy to a healthy situation, and the salutiferous water of the fountains

(7*) The definitions of eurithmy and symmetry, are very similar; proportion seems to be the meaning of both. Vitruvius frequently uses the words proportion and symmetry, synonymously; and his definitions and applications of those words, give us to understand, that the only difference he makes between them, is, that the former signifies the proportion of each member in itself, (that is, the proportion which the height, length and breadth bear to one another) and the latter, the proportion of one member to another, and to the whole object. Vitruvius also uses the word symmetry in the sense of manner, arrangement, formation, configuration, &c. and in the third and fourth Books, he uses it for order, saying, the Doric or Ionic symmetry, &c.

(8*) *Interscalmii*, are the intervals of the oar holes in galleys.

(9*) Decor, I judge to be propriety. As eurithmy and symmetry produce beauty, so decor is that which produces the appearance of propriety, and selects the qualities and appendages becoming the object.

(10*) *Statione*, Galiani has rendered *statute*, and Perault, *the state of things*. I have translated it station, judging by the sense of the context, that Vitruvius means the station, rank, quality, office, or dignity of the person for whom a building may be erected; or, if a temple, the attributes, power, or department of the deity to whom it is dedicated.

(*11) Epistylum is evidently here used to signify the whole entablature.

being administered, they are soon restored. By this means it will happen that the natural effects of the place will encrease the received opinion of the power of the Divinity.

DECOR, with regard to nature, is also observed when chambers and libraries receive their light from the east; baths, and winter apartments, from the winter west; picture galleries, and such apartments as require a steady light, from the north, because that region of the heavens is rendered neither lighter nor darker by the course of the sun, but is equal and immutable the whole day.

DISTRIBUTION^{12*} consists in the proper dispensation and application of the materials, observing moderate œconomy with regard to the expence of the work. This will happen, if the architect does not require materials that cannot be obtained, or procured, unless at a great charge; for there are not plenty of pit-sand, stones, fir, sappinus,^{13*} or marble in all places; but some grow in one place, and some in another; and to procure some, it may be difficult or expensive. Where therefore there is no pit-sand, river, or washed sea sand must be used; and for want of fir, or sappinus, the cypress, poplar, elm, or pine may be made use of; and so in other similar cases.

ANOTHER part of distribution is the adapting the building to the convenience of the owner, his fortune, rank, or dignity; it is also found to be necessary to construct the dwelling house,^{14*} different from the rustic buildings destined for the preservation of the fruits of the earth. The houses of traders, different from those of the rich and delicate. But for persons in power, by whose councils the republic is governed, things must be disposed to their use; always making the distribution of edifices suitable to every proprietor.

(12*) Vitruvius gives the word distribution a very different signification, to that we now generally allow it. He applies it to the disposal and choice of the materials; and also, to adapting the building to the fortune, dignity, and use of the owner; which latter seems rather to belong to the province of decor, as he has before explained it: it however may be considered as belonging to both; for a building cannot be said to be well distributed, unless it is suited to the owner; neither can it have propriety or decor, without being so suited.

(13*) Sappinus is the name the Romans gave to the lower part of the stem of the fir tree, which being most free from knots, was prepared in a particular manner, and reserved for the inside work. See Vitruvius, Book II. Chap. IX. and Pliny, Book XVI. S. XVI.

(14*) I differ from former translators in my conception of this passage. They have construed it as if meant to oppose a city house to a country house; I understand it, as opposing one part of the country house to another part (i. e.) the dwelling, or master's part, to the farming and husbandry

part. The ancient villas contained three parts; one was called the *urbana*, or part where the master and his family dwelt; the other the *rustica*, destined for the uses of husbandry; and the third, the *fructuaria*, or receptacle for the fruits of the earth. I am therefore of opinion, that the words *urbanas domos*, allude to the master's part, as *possessionibus rusticis* do to the husbandry part of the villa. For, as these were well known terms for those different parts of the villa, it is to be supposed, that Vitruvius would have chosen some other words to distinguish his meaning, if he had meant any thing else by them.

Vitruvius also distinguishes *possessionibus rusticis*, from *urbanas domos*, by the former's being destined for the reception of the fruits. Now, that not being the chief purpose of the whole country house, but only that of an inferior part, it cannot properly be used to distinguish the purpose of a country house, in opposition to that of a city house; but, is perfectly proper to distinguish between the farming part, and the dwelling, or master's part of the villa.

C H A P T E R III.

Of the Parts and Principles of Architecture.

TH E parts of architecture are three; Building, Dialling, and Mechanics. Building is divided into two parts, of which one relates to fortification and the construction of public works; the other is relative to private edifices. The distributions^{1*} of public works are three; one is defence, another, religion, and the third is convenience. Defence regards the erection of the walls, towers, and gates, which are to be contrived so as constantly to repel the assaults of an enemy. Religion, the sacred edifices and temples of the immortal Gods; and convenience, the common buildings for the public use; such as the Port, Forum, Porticos, Baths, Theatres, Ambulatories, and such like; which therefore are always disposed in public places. All these ought to be constructed with strength, utility, and beauty. They will have strength when their foundations are sunk to the solid earth; and when from plenty of materials, a careful choice is made without sparing. Utility, when the apartments are properly distributed, without obstruction to their use, and are exposed to the aspects which are convenient and adapted to their respective purposes. Beauty, when the form of the work is agreeable and elegant, and the proportions of the members are correspondent to the rules of symmetry.

(1*) Vitruvius, in this place, uses the word distribution in the sense of the word destination. I have here chosen to make use of the word of the text, in order to give the

reader an idea of the various and unusual significations in which the words are often used.

C H A P T E R IV.

Of the Choice of healthy Situations.

BEFORE the walls of a city is began, a healthy situation should be chosen; it should be elevated, not cloudy or rainy, and turned to that aspect of the heavens which is neither hot nor cold, but temperate. The neighbourhood of marshes is also to be avoided; for at sun-rise when the breezes of the morning, joined with the rising clouds, pass over the city, the venemous effluvia of the vermin in the marshes, mixed with the clouds, being blown and diffused among the bodies of the inhabitants, renders the place unhealthy. Cities likewise that are situated on the sea-coast, and exposed to the south or west, will not be healthy; because in the summer, the morning sun heats, and the meridian scorches the southern aspects. So also if they are exposed to the west, they are warmed at sun-rise, heated at noon, and scorched in the evening; so that by the variations of heat and cold, things in those places are soon vitiated. This may also be observed in inanimate objects; for in covered wine vaults, no one admits the light from the south or west, but from the north, because this aspect never suffers any change, but is always steady and immutable. For this reason, in granaries that are exposed to the south, the foods and fruits which are not deposited in a part that is defended from the heat of the sun, are not long preserved; for heat always dries and destroys the consistence of things, and the fervid vapours extracting the natural moisture, dissolves, softens and renders them spiritless. This we observe even in iron, which though hard in its nature, yet being intensely heated by the fiery vapours of the furnace, is so softened as to be easily wrought in all kinds of forms, and when it is thus soft and burning hot, if it is cooled again by being steeped in water, it is rehardened and restored to its former strength. It may likewise be observed, that in summer (not only in noxious, but even in healthy places) all bodies are enfeebled by the heat; and by the winter, even the most pestilential places are rendered healthy, because they are rectified by the cold; also bodies that are conveyed from cold to hot climates, cannot exist, but are dissolved; on the contrary, those that go from hot places to the cold northern regions, are not only recovered from their diseases, but are also invigorated. We should be careful therefore, not to expose cities to those regions which may diffuse hot blasts among the bodies of the inhabitants; for of the elements, which the Greeks call *Stoicheia*, all bodies are constituted; that is, of fire, water, earth and air; and these, variously mixed and tempered by nature, produce the different properties of all animals in the world. Those bodies in which the element of fire predominates, are thereby dissolved and destroyed; which evil is caused by the heat from certain parts of the heavens, entering the pores in a greater quantity than suits the natural temperament of the body. So also if too much humidity occupies the vessels of the body, it occasions an inequality, and the moisture corrupts, dilutes, and destroys the virtue and texture of the other elements; even the cold humidity of the winds and air infuses disorders in the body.

The same may be said of air and earth, the augmentation or diminution of which, in the natural constitution of the body, disorders the other elements; earth, by too much food; and air, by the density of the atmosphere.

BUT whosoever would sensibly perceive these things, must observe, and consider the nature of birds, fish, and the terrestrial animals; and he will discern their distinct temperatures; for the species of birds have one constitution, fish another, and the terrestrial natures another far different. The winged animals have little earth and water, a moderate degree of fire, and much air; being therefore compounded of the lighter elements, they easily sustain and move themselves in the air. The aquatic animals, or species of fish, are compounded of a moderate degree of fire, much air and earth, and very little moisture; so that having but a small portion of the element of water in their bodies, they can more easily exist therein, and when they are brought to land, they relinquish their life with the water. The terrestrial animals are constituted of the elements of fire and air, of little earth, and much moisture; abounding therefore in humidity, they cannot long exist in water. If, therefore, things appear to be formed in the manner we have explained, and we allow that animal bodies are compounded of these elements, the excess or deficiency of which causes disorder, we cannot doubt of the care that ought to be used, to elect the most temperate aspects, when we desire cities to be healthily situated. We should, moreover, recall to mind the rules of the ancients, who inspected the livers of the sacrificed cattle which had fed in the places where a town or abiding camp was to be established; and if the first was livid, or corrupt, they sacrificed others; doubting whether disease, or bad pasturage had occasioned it. When they had tried many, and had proved that the healthy and sound state of the livers proceeded from the goodness of the water and pasturage, they there erected their fortification; but if the livers were found vitiated, it indicated that the same diseases would in future arise in the bodies of men, from the use of the water and vegetables of those places. They therefore removed to other countries, changing places, and seeking health above all other things.

THAT the peculiar sanity of a spot is to be discovered by the pasturage and produce, may be observed and known, from the example of the country about the river Pothereus, in the island of Crete. The river is situated between the two cities Gnoson and Cortynam; and upon the right and left the cattle feed; but those that feed next Gnoson have a milt; and those on the other side, next Cortynam, have no appearance of any. The physicians, upon searching after the cause, discovered in those places certain herbs, on which the cattle feeding, diminished their milt; upon this, they collected those herbs, and make use of them as a medicine to cure the spleen, which herb the Cretans therefore call *asplenon*. From this example it may be concluded, that the vegetables and water of countries naturally occasion them to be noxious or healthy.

CITIES that are built in lakes, near the sea, and exposed to the north, or between the north and east, provided the lake is higher than the bed of the sea, will not be ill situated; for by making trenches, the water will run off to the sea-shore; and the sea when

swoln^{1*} by tempests reflowing into the lake with violent motion, and mingling with the stagnated water, will not suffer any kind of vermin to breed; for such vermin as breed in higher places, upon coming near the sea-coast are destroyed by the unaccustomed saltness. Examples of this kind are the Gaulic lakes, which are near Altina, Ravenna, and Aquileja. There are also other towns in the neighbourhood of lakes, which are for this reason, incredibly healthy; but such lakes as, like the Pontinæ^{2*}, are stagnant, and have no efflux, either by rivers, or trenches, become putrid, and emit gross and pestilential vapours in those places. The ancient city of Salapia, in Apulia, which was founded by Diomedes, at his return from Troy, or, as some write, by Elphias, the Rhodian, was disposed in such a place, that the inhabitants were every year afflicted with diseases; at last they applied to M. Hostilius, and, in the name of the public, requested, that he would search for, and elect them a proper place to which they might transfer their city. To this he consented, and without delay, sought, according to the most approved methods, for a healthy spot upon the sea-coast; purchased the possession; petitioned the senate and people of Rome for leave to transfer the town; raised the walls, divided the areas, and then, for a festertius each, gave free possession to the citizens. This done, he opened the lake to the sea, made it the port, and so perfected the city. The Salapines therefore now inhabit a healthy situation, four miles distant from their old town.

C H A P T E R V.

Of the Construction of the Walls and Towers.

WHEN therefore, by the above means, the situation chosen for the city is found to be salutary, the soil fertile, yielding food sufficient for the sustenance of the inhabitants, and the approaches easy, or having the accommodation of a river, or sea-port, to expedite the carriage of goods to and from the city; then the foundations of the towers and walls are to be thus constructed: the ground is to be dug down to the solid earth, and in the solid, so far as seems reasonable for the magnitude of the work. The foundation walls are to be thicker than those which are built above ground, and they must be executed in the firmest manner.

(1*) There are little or no tides in the Mediterranean sea; to which Vitruvius had chiefly regard; he therefore supposes that sea to be raised only by tempests.

(2*) Pontinæ was a lake in the Campania, eighteen miles distant from Rome.

Fig. I. ON the outside, towers (D) are erected, that when enemies hostilely approach the walls, they may be wounded by the darts from the towers, on their right and left; particular care is to be taken that the assailants may not easily advance to batter the walls, encompassing the place with a ditch, and contriving the approaches to the gates, not to be direct, but *scaia*^{1*}; for when they are thus made, the right side of the besiegers, which is not covered with a shield, will be exposed to the walls.

CITIES are not to be formed quadrangularly, or with projecting angles, but circuitously^{2*}, that the enemy may be descried from many parts: for those projecting angles are difficult to defend, and are a greater security to the enemy than to the city. The thickness^{3*} of the walls I judge should be such, that when the armed men happen to meet, they may pass each other without obstruction^{4*}. In the thickness, olive piles scorched, and ranged very close, are laid; so that the walls having both fronts thus bound together, are excessively strong: for this wood is not affected, either by the weather, rot, or age; but whether it is buried in the earth, or sunk in the water, it remains always sound and serviceable. If, therefore, not only the walls above ground, but also the foundations, and other thick walls, were united in this manner, they would not speedily decay.

Fig. I. THE distances^{5*} of the towers (D) are so regulated as not to be greater than the darts will reach; that in case of an assault, the enemy may be repulsed by the scorpions and other missiles from the towers on the right and left. Also opposite to the interior

Fig. IV. part (E) of the towers the wall is to be divided, the interval being as large as the tower; and the passage way (F) in that place is to be made with timber, and not fastened with iron; that if the enemy should gain that part of the walls, it may be cut by the besieged so speedily, as not to permit the assailants to penetrate farther without precipitating themselves. The towers are made either round or polygonal; for the machines soon destroy those which are made square, and their angles are broke by the battering rams. But the round, like wedges driving to their center, cannot be easily damaged.

(1*) *Scaia*, signifies oblique, or inclining to the left. See the letters C, C, Fig. I.

(2*) Vitruvius's word is *circuitationibus*, by which, I do not suppose he means that cities are always to be upon the plan of a circle, or any regular polygon; but that they should be convex in every part, though their figure may be various and irregular, according as their situation, the nature of the adjacent country, or other circumstances may make proper.

Several of the translators have in their draughts, represented the city upon the plan of an octagon, dodecagon, &c. placing the towers at the angles only. Vitruvius, a little farther on, says, that the distance of the towers from each other should not be greater than the throw of a dart, which we may suppose was about eighty or a hundred feet; as the towers which Julius Cæsar erected at the siege of Bourges, were at that distance. It follows, therefore, that the cities, according to the supposition of the said translators, must be included within the periphery of eight or twelve hundred

feet; which, though large enough for a fortress, or citadel, would make but a very diminutive city.

(3*) In the ancient manner of fortification it was usual to make a passage in the thickness of the walls, near the top, open with arches next to the town, and having small apertures next to the enemy. In this passage, as well as on the top of the wall, the soldiers were posted for the defence of the place. Such a passage is still to be seen in the remains of the ancient walls of Rome, built by the emperor Aurelian. See b, b, in the plan and elevation, Fig. IV.

(4*) Vitruvius says, the walls should be so thick that the soldiers may pass each other with ease; but it must be supposed that he means exclusive of the thickness of the battlements, which defend and screen the men from the enemy.

(5*) Julius Cæsar, at the siege of Bourges, erected towers eighty feet apart, as before mentioned. See D, D, Fig. I.

IF a bulwark^{6*} (H, I,) is adjoined to the walls and towers, it will render them more secure; for they cannot then be much annoyed either by the rams, mines, or other machines; though it is not necessary to make these bulwarks in all places; but only where there is some elevated place without the walls; from whence the city may be easily assaulted. In those places, therefore, a ditch of a great breadth and depth is first to be dug; in which the foundations of the walls are laid, and built of such a thickness, that they may easily sustain the pressure of the ground. On the inside of the substruction, another foundation (G) is laid, at an ample distance inwardly from the exterior, so that the cohorts may be contained and exercised on the breadth of the bulwark. When these foundations are built thus distant from each other, then between them other transverse walls^{7*} (H, H,) are built, joining the exterior and interior foundations; being disposed like the teeth of a comb, (I, I,) or in the manner of a saw (H, H,). For when they are so made, the great mass of earth, being distributed into small parts, cannot act with its united weight, or be able to force out the foundation walls.

BUT the materials of which these walls should be built, cannot be determined; because in all places we cannot have plenty of the best materials; where free-stone, flints, rubble, or bricks, burnt or unburnt, can be obtained, they must be used; for all places have not the advantage of Babylon, where there is an abundance of a liquid bitumen, which serves instead of lime and sand, and the walls are built with burnt bricks. But all countries, or places, may have their peculiar advantages, and some kind of substances, with which, by these methods, the walls may be made durable, and without defect.

C H A P T E R VI.

Of the Division and Disposition of the Works within the Walls.

THE walls being finished, the next thing is the division of the area within the walls, and the direction of the streets and lanes to the proper regions of the heavens. These will be properly directed, when those winds are judiciously excluded from the streets, which, if

(6*) Perault, Galiani, and Barbaro, have supposed this bulwark to be as high as the top of the wall. In the fore-mentioned example of the walls of Rome, some remains of such a bulwark are still to be seen, by which it appears, that it was raised only one story high from the level of the city, in the manner of a terrace. See H, G, Fig. I, and IV.

(7*) Adjoining to that part of the walls of Rome, where

anciently stood the *Castro di Tiberio*, are yet to be seen the remains of walls disposed like the transverse walls here described, and were probably for the same purpose. These transverse walls, and part of the city wall adjoining, was rebuilt by Constantine, having been destroyed, together with the Castro, in the war between him and Maxentius.

cold, offend; if warm, corrupt; and if humid, are infectious; care therefore should be taken to avoid this evil, which in many cities usually happens. The town of Mitylene, in the island of Lesbos, is magnificently and elegantly built, but injudiciously disposed. In this city, when Auster blows, the inhabitants are sick; when Corus, they have coughs; and when Septentrio, they are restored to health; but they cannot then remain in the lanes and streets, on account of the severity of the cold. Wind is only a current of air, flowing with uncertain motion; it arises from the action of heat upon moisture; the violence of the heat forcing out the blasts of air. That this is the fact, the brass æolipyles make evident: for the latent operations of the heavens and nature may be discovered by the action of artificial machines. These brass æolipyles are hollow, and have a very narrow aperture, by which they are filled with water, and then placed on the fire. Before they become hot, they emit no effluvia; but as soon as the water begins to boil, they send forth a vehement blast; so that from this little easy experiment, we are able to judge of the causes of the great and mighty winds of heaven, and of the works of nature. If then a city is thus defended from the winds, it is not only rendered salutary to bodies in health, but also those diseases, which have arisen from the malignity of other places, and which require the application of medicines, in this are soon removed by the means of the temperate state of the air. The maladies which are cured with difficulty in the places abovementioned are, colds, the gout, coughs, pleurifies, consumptions, the emission of blood, and such like; which are not cured by diminution, but by augmentation. The reason these are with difficulty remedied, is, first, because they are occasioned by cold; and secondly, because the disease having already impaired the strength, the air agitated and attenuated by the motion of the winds, extracts the juices from the diseased bodies, and thus renders them still weaker. On the contrary, mild dense air, not in frequent fluctuation, or redundance, nourishes and restores the members of those, who are afflicted with such infirmities.

SOME will not allow that there are more than four winds; *Solanus*, the equinoctial east; *Auster*, the south; *Favonius*, the equinoctial west; and *Septentrionus*, the north. But there are found to be eight, by those who have more attentively considered the subject. Of these Andronicus Cyrrhestes is the chief; who, as an example, built at Athens, an octogonal tower of marble; and on the several sides of the octogon carved the images of the several winds; disposing each opposite to its respective region: on the top of the tower he erected a marble metæ, upon which he placed a triton of brass, with his right hand extended, holding a wand, and so contrived that it was turned by the wind, always standing opposite to the blast, and holding the wand over the image of the wind that then blew. There is therefore, between Solanus and Auster, Eurus, or the winter east; between Auster and Favonius, Africus, or the winter west; between Favonius and Septentrionus, Caurus, which many call Corus; and between Septentrionus and Solanus, Aquilo; and in this manner they are

(1*) In a French translation of Vitruvius, by Jean Martin, in 1572, there is a design of this tower of Andronicus Cyrrhestes; but since the publication of the ruins of Athens,

by Mr. Stuart, we have the satisfaction of seeing the true and accurate draught of the original.

described, that the number and names of the several winds, and the parts from whence they blow, may be clearly understood.

Fig. I. and II. HAVING thus far premised, to discover their regions and sources, this is the method. A marble compass exactly levelled, is placed in the middle of the city,

or else the place itself so well polished and levelled, as to render a compass unnecessary. In the center of this place is fixed a metal gnomon to cast a shadow, which the Greeks call *Sciatheras*: about the fifth hour^{2*} in the forenoon, the extremity of the shadow of the gnomon

Fig. II. is observed, and marked with a point; then with the compasses extended so much as is equal to the length of the shadow of the gnomon, a line is circumscribed

round the center. In the afternoon also the encrease of the shadow is observed; and, when it touches the circular line, making the afternoon shadow equal to that of the forenoon, another point is made. From these two points describing an intersection with the compasses, and from that intersection producing a line through the central point to the extremity, the southern and northern regions are found. After this, taking with the compasses the sixteenth part of the whole circumference of the circle; and placing the central foot in the meridian line, where it touches the circumference, marks are made therewith on the circle to the right and left, both on the southern and northern side. Then from these four points, lines are drawn through the center, from extremity to extremity of the circumference, intersecting each other; thus the south and north have each an eighth part assigned them; the remaining parts are equally distributed in the whole circumference, three to the right, and three to the left, according to the eight equal divisions of the winds. This done, the directions of the streets and lanes are disposed in the angles, between every two winds; as, by this method, the habitations will be defended from their hurtful and offensive violence. For when the streets are disposed directly opposite to the winds, the impetuous blasts that frequently descend from the open space of heaven, being confined in the narrow entrances of the streets, fly through them with greater violence. But when the direction of the streets are turned from the region of the winds, the blasts, meeting with the angles of the islands^{3*} of houses, are broke, repulsed, and dissipated.

PERHAPS, those who know the many names of winds, will wonder that we have described no more than eight; but if they consider that the circumference of the earth is, by the course of the sun, and the shadow of equinoctial gnomons, arising from the inclination of the heavens, found by Eratosthenes Cyrenus, according to mathematical rules and geometrical process, to be two hundred and fifty two thousand stadia; which make thirty-one million five hundred thousand paces, and that the eighth part of this which is occupied by each wind, is three million nine hundred and thirty-seven thousand five hundred paces, they will

(2*) The Romans divided the day into twelve hours, beginning from sun-rise; as the night also consisted of twelve, beginning from sun-set; the fifth hour, therefore, in the forenoon, must be about one hour before noon, or,

as we express it, eleven of the clock.

(3*) A pile of houses, or buildings surrounded by streets, was called an island. Suet. Life of Nero.

not wonder that one wind ranging in so great a space, should make various inflections, returns, and changes.

AUSTER, therefore, has on his right and left, Euronotus, and Altanus; Apricus has Libonotus, and Subvesperus; Favonius has Argestes, and at certain times Etesia; Caurus has on either side Circius, and Corus; Septentrio has Thrafcias, and Gallicus; on the right and left of Aquilo, are Supernas, and Boreas; Solanus has Carbas, and at certain times Ornithia; Eurus, occupying the middle part, has on either side Cacias, and Volturnus. There are many other names of winds derived from countries, rivers, or mountains; there are also the Auræ Matutinæ, which the sun, when it rises from the subterranean regions, acting violently on the humid air, forces out from the vapours of the dawn; these remain after the sun is risen, holding the part of the eastern winds, which for this reason appear to have been called Euros by the Greeks; as also, the morning, from these Auræ Matutinæ, they called Aurion. Some there are who deny that Eratosthenes could compute the true measure of the earth; but supposing that to be the case, it does not invalidate our description of the regions from whence the several winds arise, but only renders the just measure of the space occupied by each wind, indeterminable, and uncertain.

To illustrate and facilitate the conception of these things, which are but briefly explained, two figures, or, as they are called by the Greeks, *Schematæ*, are placed at the end of the book: one is contrived to shew the regions, from whence the several winds arise; the other, to shew the manner of disposing the lanes and streets, so as to avoid their noxious blasts.

Fig. II. THE center of the level plain is shewn by the letter A, the shadow of the gnomon in the forenoon is at B. Extending the compasses to the mark of the shadow at B, describe a circle. Let the gnomon remain, and wait while the shadow decreases, and again encreases, till the afternoon shadow is equal to that of the forenoon, and touches the line of the circle at C. Then extending the compasses from B to C, describe an intersection D, and from that intersection, continue a line through the center to the letters E and F, at the extremities; this line will indicate the southern and northern regions. Then with the compasses, taking the sixteenth part of the whole circumference, and putting the central foot in the meridian line, where it touches the circumference at E, make marks to the right and left, where the letters G and H are placed. On the north side also, setting the central foot of the compasses in the circle, at the north line, where F stands, mark to the right and left, where the letters I and K are placed; draw lines from G to K, and from H to I, passing through the center. Thus the space from G to H, will be the province of the wind Auster, and of the southern regions; as the space from I to K, will be that of the northern. The remaining parts, three to the right, and three to the left, are equally divided; those to the east are marked with the letters L and M, and those to the west with N and O; from M to O, and from L to N, lines are drawn, intersecting each other, and thus the circle will be divided into the eight equal spaces of the winds.

(4*) The morning breezes.

WHEN it is thus described, these letters will stand at the several angles of the octogon, beginning at the meridian. Between Eurus and Aufter, the letter G; between Aufter and Aphricus, H; between Aphricus and Favonius, N; between Favonius and Caurus, O; between Caurus and Septentrio, K; between Septentrio and Aquilo, I; between Aquilo and Solanus, L; and between Solanus and Eurus, M. This being compleated, the gnomon is fixed between the angles of the octogon, and thus the IIXth divisions of the streets and lanes are directed.

C H A P T E R VII.

Of the Situation of the Public Buildings.

THE lanes and streets being divided and disposed, the situation of the squares, temples, forums, and the other public buildings, for the convenience and common use of the city, is next to be explained. If the city is near the sea, the area designed for the forum should be chosen near the port; but in an inland place, it should be situated in the middle of the town (A). The temples of those deities that are the tutular guardians of the city; as also those of Jupiter, Juno, and Minerva; are to be situated in an elevated place, from whence the greater part of the city is discoverable; the temples of Mercury are placed in the forum, or in the emporium; as are those of Isis, and Serapis; those of Apollo, and Bacchus, are near the theatre; that of Hercules, in such cities as have no gymnasiæ, nor amphitheatre^{1*}, is to be built near the circus^{2*}; that of Mars, without the city, but near the camp; that of Venus, also at the gate; for it is written in the doctrines of the Etruscan Aruspices, that the fanes of Venus, Vulcan, and Mars, should be placed without the walls; that the youth and matrons may not be accustomed to the sight of libidinous pleasures; and

(5* IIX) Signifies two less than ten, that is eight.

(1*) It was the custom of the Gladiators, when they were excused any farther performance in public, to hang up their weapons in the temple of Hercules; which, therefore, was usually adjoining the place of performance; whether it was an amphitheatre, or circus.

(2*) Vitruvius here mentions amphitheatres, and circus's, but gives us no description of either. See the Observations on the Life of Vitruvius.

(3*) Some of the translators observe, that these rules for

situating temples were not always observed; for Julius Cæsar built a temple to Venus, within the city, as Augustus also did to Mars; but in both these instances it may be considered that there were particular circumstances, which might be the reason of deviating from the general custom. Julius Cæsar boasted of being descended from Venus; and Augustus erected this temple to Mars, as his patron and protector, in consequence of his gaining the victory at the battle of Phillipæ. These emperors, therefore, considering those deities as their particular patrons, might be the reason of their giving them place within the city, contrary to the common usage.

that of Vulcan being placed without the city, contributes to secure the buildings from fire, by calling out the religious rites and sacrifices of that god. So when the fane of the god Mars is dedicated without the city, it is thought no civil dissensions will happen therein, but it will be defended from its enemies, and the dangers of war. The temple of Ceres is also situated without the city, in a place which men do not frequent, except at the time of the sacrifices; for with devotion, chastity, and purity of manners, this temple should be approached. The other deities have their temples situated in places suitable to the forms of their sacrifices.

BUT the rules for building sacred edifices, and the symmetry of their plans, are given in the third and fourth books. For it appears to me proper, previously to treat in the second book, of the materials necessary to be prepared for buildings, and of their qualities and uses; and in the several books to explain the proportions of the several kinds of buildings, their ordination, and symmetry.

THE END OF THE FIRST BOOK.

T H E
A R C H I T E C T U R E
O F
M · VITRUVIUS · POLLIO.
B O O K T H E S E C O N D.

P R O E M.

AT the time that Alexander was conquering the world, Dinocrates,^{1*} the architect, confiding in his knowledge and genius, and being desirous of obtaining the royal commendation, left Macedon, and repaired to the army. He carried with him letters from his relations and friends in his own country, to the nobles of the first rank, that he might thereby more easily gain access. Being favourably received, he requested to be immediately presented to Alexander; they gave him many promises, but made delays, pretending to wait till a proper opportunity should offer. Dinocrates, therefore, suspecting that he was derided, sought the remedy from himself. He was very large of stature, had an agreeable countenance, and a dignity in his form and deportment. Trusting to these gifts of nature, he clothed himself in the habit of an host, anointed his body with oil, crowned his head with boughs of poplar, put a lion's skin over his left shoulder, and holding one of the claws in his right hand, approached the tribunal where the king was administering justice. The novelty of the appearance attracting the notice of the people, occasioned Alexander also to see him, who, wondring at the sight, commanded way to be given, that he might approach. Alexander then demanded who he was; Dinocrates replied, I am a Macedonian architect, who comes to thee with ideas and designs, worthy of the greatness of thy fame; I have formed a design to cut mount Athos into the statue of a man, in whose left hand shall be a large city, and in his right, a basin, which shall receive all the rivers of the mountain, and again discharge them to the sea. Alexander delighted with the idea, immediately enquired, if the country adjacent would produce sufficient food for the sustenance of the inhabitants. When he understood that provision must be conveyed thither by sea, he replied; Dinocrates, I discern the excellence of thy design, and am pleased with it; but I consider, that whoever should establish a colony in such a place, would hereafter be justly blamed; for, as a new born

(1*) This architect is called by Pliny, B. 5. S. 11. *Dinochares*; and by Plutarch, in the Life of Alexander, *Stasicles*; by some *Chinocrates*; and by others, *Chironocrates*.

infant cannot be nourished, or gradually reared to the different stages of life, without the milk of the nurse; so neither can a city be peopled, nor can it thrive, without fertile land and plenty of provision: however, as I approve the design, though I disapprove the place, I will have thee attend me, that elsewhere I may employ thee. From that time, Dinocrates remained with the king, and attended him into Egypt. There Alexander, observing a spot which had an haven formed secure by nature, an excellent place for an emporium, the adjacent country through all Egypt being fruitful, and having the accommodation of the river Nile, ordered him to build the city now called from his name Alexandria. Thus, by the means of a graceful countenance and dignity of person, Dinocrates became eminent. But to me, O emperor, nature has not given greatness of stature; age has deformed my face, and infirmity has impaired my strength; being therefore deprived of those advantages, I endeavour, by the help of my knowledge and writings, to merit commendation.

As in the first book, I have spoken of the use of architecture, and the constituent parts of the art, the fortifications, and the division of the area within the walls, it follows, as next in order, that the proportion and symmetry of temples, and public as well as private edifices, ought to be explained; but I judge it most proper to defer their description, till I have previously discoursed on the several materials of which buildings are constructed; the rules for working them, their qualities, and the elements of which they are by nature constituted; and before I begin to explain the nature of these things, I shall speak of the uses of buildings, their origin, and how they were invented; also of the ancient state of things; and whatsoever I have learnt from those who have wrote on the origin of civil life, and useful inventions.

C H A P T E R I.

Of the Original of Buildings.

IN ancient times, men, like wild beasts, lived in forests, caves, and groves; feeding on wild food, and in that manner spending their time. In a certain place it once happened, that the trees, being agitated by tempestuous winds, rubbing their branches one against another, took fire. Those who were near the place, affrighted at the violent conflagration, fled; but afterward, as the flames abated, resuming courage, they approached nearer, and finding the heat to be very comfortable to their bodies, they threw more wood into the decreasing fire, and thus preserved it. They then invited other men, making signs to them, to express their opinion of its convenience. Men, thus assembled, made various sounds with their voice; and by daily practice, some certain sounds, by which they signified the things in frequent use, obtained, and became established. From this casual event language arose; and hence they began to converse together. Fire, therefore, having thus occasioned men to assemble, discourse, and live together, by having attracted many to one place, they soon observed that they were by nature superior to other animals; as not being prone, but walking erect, beholding the beauties of the earth and the heavens; also that, by means of their hands and fingers, they could easily make any thing they pleased; they, therefore, began to make themselves coverings with the boughs of trees; some dug caves in the mountains; and others, in imitation of the nests of swallows, with sprigs and loam, made shelters which they might lie under; and by observing each other's work, and turning their thoughts to discover something new, they by degrees improved and made a better kind of habitations. But men being of an imitative and docile nature, glorying in their daily inventions, and shewing one another the houses they had made, they, by these endeavours and exertions of their faculties, became in time more skilful.

At first, to serve for the walls, they erected forked stakes, and disposing twigs between them, covered them with loam; others piled up dry clods of clay, binding them together with wood; and to avoid the rain and heat, they made a covering with reeds and boughs; but finding that this roof could not resist the winter rains, they made it sloping, and pointed at the top, plaistering it over with clay, and by that means discharged the rain water. That the origin of things was, as above written, may be concluded from observing that to this day, some foreign nations construct their dwellings of the same kind of materials; as, in Gaul, Spain, Lusitania, and Aquitain, they use oak, shingles, or straw. The Colchians, in the kingdom of Pontus, where they abound in forests, fix trees in the earth close together, in ranks to the right and left, leaving as much space between them, as the length of the trees will permit; upon the ends, others are laid transversely, which circumscribe the place of habitation in the middle; then, at the top, the four angles are braced together with

alternate beams; and thus the walls, by fixing other trees perpendicularly on those below, may be raised to the height of towers. The interstices which, on account of the coarseness of the materials, remain, are stopped with chips and loam. The roof is also raised by beams laid across from the extreme angles, gradually converging, and rising from the four sides to the middle point at the top, and then covered with boughs and loam. In this manner, the barbarians make the testudinal roofs of their towers. The Phrygians, who inhabit a champaign country, being destitute of timber, by reason of the want of forests, select little natural hills, excavate them in the middle, dig an entrance, and widen the space within as much as the nature of the place will permit; above, they fix stakes in a pyramidal form, bind them together, and cover them with reeds, or straw, heaping thereon great piles of earth. This kind of covering renders them very warm in winter, and cool in summer; some also cover the roofs of their huts with the weeds of lakes; and thus in all nations and countries, the dwellings are formed upon similar principles. At Marseilles, we may observe the roofs without tiles, and covered with earth and straw; at Athens, the Areopagus is at this day an example of the ancient roofs of loam; at the Capitol also, the house of Romulus^{*}, in the sacred citadel, may remind us of the ancient manner of covering our roofs with straw. By these examples, therefore, we may be assured, that the first invention of building happened in the manner we have related; but at length, mankind by daily practice improved, and by repeatedly exercising their faculties and talents, arrived at the full knowledge of the art; those who were most experienced professing themselves artificers. When, therefore, these things were thus far advanced, as Nature had not only given to mankind sense in common with other animals, but had also furnished their minds with judgement and foresight, and had subjected other animals to their power, they, from the art of building, gradually proceeded to other arts and sciences, and from a savage and rustic way of life, became humane and civilized. Then, when their minds were thus enlightened, and they became more judicious by experience, and the advancement of the various arts and sciences, they no longer built huts, but founded houses, with walls constructed of bricks, stones, or other materials, covering the roofs with tiles. Hence by application to the arts, they, from wandering, and uncertain opinion, arrived at the certain knowledge of the laws of symmetry; observing also, that nature afforded a great variety of timber, and other materials fit for building, they availed themselves of that advantage, and thus improving in the arts, they extended them to encrease the pleasures and elegancies of life. I shall therefore, as well as I am able, treat of the proper application of the several materials, and of their natures and qualities.

IN case some should object to the order of this book, and be of opinion that it ought to have been placed first, I shall here give my reason for believing I have not erred in that

(1*) The house of Romulus was a hut, which was built on the Capitoline hill. It was not the residence of Romulus, for it is certain that he dwelt on mount Palatine; the Capitoline not being included within the walls, at the first build-

ing of the city. This hut the Romans religiously observed never to repair with any other materials than reeds and straw, in commemoration of their founder.

respect. As I propose writing a full System of Architecture, I judged it proper, in the first book, to mention the learning and science with which that art should ever be accompanied; to determine the extent of its nature, and of what parts it consists; specifying all the knowledge that is required in an architect: as, therefore, I have in the first book described the use of the art; I ought in this, to explain the qualities and uses of the materials: for this book treats not only of the origin of architecture, but also of the institution of buildings; from what causes they sprang, and gradually attained their present perfection. This, therefore, is the proper place and order of this book.

Now, returning to our subject, to discourse explicitly concerning the materials used in buildings, of the manner in which they are found to be generated by nature, and what elements are united in their composition. For no kind of materials, or substances, can grow, without the mixture of the elements. Neither can they be understood or explained according to the doctrine of physics, unless their causes are known, and the manner, and reason why they so exist, is demonstrated.

C H A P T E R II.

Of the Principles of Things, according to the Opinion of Philosophers.

THALES believed water to be the principle of all things; and Heraclitus, of Ephesus, who, from the obscurity of his writings, is called by the Greeks, *Scotinos*, fire; Democritus, who is followed by Epicurus, atoms; which we call indivisible; others individual corpuscles; for the philosophy of Pythagoras adds air and earth, to water and fire. Democritus, therefore, did not properly describe things; but nevertheless supposed individual corpuscles, as appears by his own words, and which, when disjoined from each other, are incapable of injury, decay, or division; but must eternally endure, and retain their solidity. As, therefore, all things seem to be constituted, by the combination of these atoms, and are divided into an infinite number of different kinds, I think it not unnecessary to treat of the varieties and divers properties of those which are used in buildings; that, when they are known, those who intend to build may not misapply them, but properly adapt the materials of buildings to their several uses.

C H A P T E R III.

Of Bricks.

I SHALL first speak of bricks, and the earth of which they should be made. They should not be made of sandy, stoney, or gravelly loam; for such kinds of earth, in the first place, render them heavy; and, secondly, upon being wetted with the rain, after they are laid in the wall, they swell and dissolve; and the straw which is put in them, does not adhere on account of their roughness. Bricks should be made of earth that is white and chalky, or red, or having a masculine large sand; for these kinds being light and strong, are not weighty in working, and are laid with facility. They should also be made in the spring, or autumn, as being the best time of drying; for those made in the summer, are not sound, on account of the intense heat of the sun, which parches the outside, before the inside is sufficiently dry; which afterward drying in the building, causes them to shrink and break others which were dry; by that means rendering the structure infirm, and full of fractures. They are best when made two years before they are used; for they cannot be sufficiently dry in less time. If they are used when newly made, and moist, the plaister work which is laid on them, remaining firm and stiff, and they shrinking, and consequently not preserving the same height with the incrustation, it is by such contraction loosened and separated; by this means the plaistering breaks, and falls from the building; for, on account of its thinness, it cannot stand of itself; and the walls themselves are sometimes damaged thereby. At Utica, therefore, the laws allow no bricks to be used before they have lain to dry five years, as must be proved to the magistrates, by whose authority they may then be used for the building of walls.

Fig. V. THERE are three sorts of bricks; one which the Greeks call *Didoron*, which are such as we use; they are a foot long, and half a foot broad. The other two sorts are used in the buildings of the Greeks; one of which they call *Pentadoron*, and the other *Tetradoron*; for the Greeks call the palm *Doron*, because a gift which is always presented with the palm of the hand, is in Greek called *Doron*; those bricks, therefore, which have on every side five palms, are called *Pentadoron*, and those which have four, *Tetradoron*; in public works they use the former; and in private, the latter. Of these bricks

Fig. VIII. they also make half bricks; and in working, the whole bricks (a) are placed in one course, and the half bricks (b) in the other. So that when both parts are built to a level, they appear to be laid in the walls with alternate faces outward, the middle of the bricks being disposed perpendicularly over the joints, giving strength, and not

(1*) It is not known what kind of sand Vitruvius means by the words *Masculo Sabulone*. Several of the commen-

tators have given their conjectures concerning it; but none appear satisfactory, or worth mentioning.

an unhandsome appearance to both parts.²² At Calentum, in the farther Spain; at Marfeilles, in Gaul; and at Pitane, in Asia; there are bricks which, when made and dried, will swim, if thrown into the water. The reason they swim is, because the earth of which they are made, is pumicofeous, and replete with air, not receiving or imbibing the water; being therefore light and porous, and not suffering the water to penetrate into its substance; however large the mass may be, the bricks, in the same manner as pumice stones, are sustained on the water. The Calentines have therefore a great advantage; for these bricks are not weighty in the building, and when once made, cannot be impaired by the weather.

C H A P T E R IV.

Of Sand.

IN all cementitious buildings, the first thing to be considered is the sand; it should be such as will mix well in the mortar, and have in it no mixture of earth. The kinds of pit-sand are, the black, white, red, and carbuncle; of these, such as crackles upon being rubbed in the hand, are the best; for such as are earthy have not that asperity; such also as, being thrown on a white garment, do not soil it, or leave any dirt thereon, are good. But in places where there are no pits, sand must be procured by sifting of gravel, or taken from rivers, as well as from the sea-shore; but this latter is not good for building, because it dries with difficulty, and walls wherein it is used cannot be built without intermissions of rest, nor will they bear the pressure of arched floors; also in buildings where the walls are plaistered, the salts exuding from sea-sand, dissolves the plaistering; whereas buildings in which pit-sand is used, quickly dry, the incrustation stands firm, and the walls will sustain

(2*) Vitruvius does not mention the thickness of the bricks; the ancients made their bricks very thin, almost like tiles, as appears by their remains. The thickness, therefore, might be an established measure, or dependent on the superficial magnitude of the brick.

The bricks, *Tetradoron*, and *Pentadoron*, used by the Greeks, were square, having, as Vitruvius says, every side equal, each side of the former measuring four palms, and of the latter, five. The *Didoron* bricks, which the Romans used, were oblong, being a foot long, and half a foot broad, that is, four palms long, and two broad, which is exactly equal to half a *Tetradoron* brick. As, therefore, the Greeks made half bricks of each of the sorts which they used; the half *Tetradoron* bricks of the Greeks were exactly similar to the *Didoron* bricks of the Romans, and might be laid in the same manner, and make just the same appearance in the work.

Barbaro, Alberti, and some others, have supposed these half bricks were made by dividing the whole brick diagonally, so that they become triangular; of which kind some are still to be seen in the remains of the walls of Rome, in that part particularly which was built by the emperor Aurelian; but it is evident that Vitruvius does not here mean that triangular sort, but a quadrangular kind, made by dividing the whole brick quadrilaterally; for he speaks of their appearing to be laid in the wall with alternate faces outward; thereby implying that the faces were of different dimensions, which is not the case of the two sides of such triangular bricks. The diagonal side is indeed of a different dimension from the other two; but it cannot be probably supposed that Vitruvius means that side to be used alternately with the others, its measure being to disproportionate and incongruous to the square sides, that they can never be made to agree together in any regular order.

the weight of the arches. Sand should be used fresh from the pit; for if it lays long exposed, it is, by the action of the sun, moon, and rain, diluted, weakened, and made earthy; and, if then used in any structure, it will not consolidate the materials, which therefore separate and fall, rendering the walls unable to sustain their burthen. But though pit-sand is so well adapted for building of walls, it is not proper for incrustations; for, on account of its fatness, which causes a violent fermentation when mixed with the lime and straw, it will not dry without cracking. But river sand, by reason of its meagreness, being beaten with staves like signinum^{1*}, makes the plaistering strong and durable.

C H A P T E R V.

Of Lime.

SAND having been sufficiently explained, lime must also be properly considered; it should be burnt from white stone, or flint, of which the thick and hard sort are more proper for building walls, as those which are porous are for plaistering. When the lime is burnt, the ingredients are thus to be mixed; with three parts of pit-sand, one part of lime is to be mingled, but if river or sea-sand is used, two parts of sand, with one of lime, must be united; for in these proportions the mortar will have a proper consistence: if bricks, or tiles, pounded and sifted, be joined with river or pit-sand, to the quantity of a third part, it will make the mortar stronger, and fitter for use. The reason that lime, when saturated with water and sand, consolidates the materials, seems to be this: stones, as well as all other substances, are compounded of the elements; those which have most air, are tender; those which have most water, are, by reason of their humidity, tenacious; those which have most earth, are hard; and those which have most fire, brittle. If these stones were only pounded into minute pieces, and mixed with the sand without being burnt, they would not indurate, or unite; but when they are cast in the furnace, and there penetrated by the violent heat of the fire, they lose their former solidity; and being calcined and deprived of their strength, they are left exhausted, and full of pores. The water and air, therefore, which are in the substance of the stones, being thus discharged and expelled, and the latent heat only remaining, upon being replenished with water, which repels the fire, they recover their vigour, and the water entering the vacuities, occasions a fermentation; the substance of the lime is thus refrigerated, and the superabundant heat ejected. But the stones, when

(1*) Signinum, is, according to Pliny, Book 35, C. 12, a kind of mortar made with lime, mixed with broken tiles, or earthen vessels, beaten very small. Vitruvius himself, at Book 1, Chap. 7, says, it is made with pure rough sand,

and lime made of flint-stones. Galiani writes, sand, lime, and flint-stones; but I think he mistakes the sense of the passage.

taken out of the furnace will not be of the same weight they were before they were burnt; for, if weighed, though the magnitude will remain the same, they will be found to be decreased in weight, by the evaporation of the humidity, about a third part. When, therefore, their pores and cavities are again saturated with sand, they unite and dry together, and by that means consolidate the materials.

C H A P T E R VI.

Of the Earth of Pozzuoli.*

THIS is a kind of earth that naturally produces admirable effects: it grows in the territory of Baiæ, and in the municipal lands about the mountain Vesuvius: being mixed with lime and bricks, it not only renders common buildings exceedingly strong, but also strengthens moles which are built in the sea; for it presently sets, and becomes hard, under the water. The reason of this appears to be, that as under all this mountain and country adjacent there are great fires of burning sulphur, alum, or bitumen, as may be known by the many hot springs thereabout, the flaming vapours arising from these internal fires, pervading and burning in the interstices, render the earth light, and the sand that grows there dry, and without moisture. When, therefore, these three things, all arising from a similar cause, viz. the intense heat of fire, are blended together, upon receiving water they speedily unite, and, by means of the humidity, soon become hard and solid; nor can the waves, or utmost violence of the water, separate them. That there is fire in those places, is indicated by these circumstances: in the mountains of Cumæ and Baiæ, sweating caves are dug, from the bottom of which issues a fervid vapour, which by means of its heat perforates the earth, and springs forth in those places; making excellent and useful sudatories. It is moreover reported, that in former times the fire increased and superabounded under the mountain Vesuvius, from whence a flaming matter was ejected around the country, which matter is now called the pompeianian sponge, or pumice. This appears to be formed of various kinds of stones burnt, and reduced to that state and quality; for such spongy kind of stones grow in no other places, except about mount Ætna, the Mysian hills, named by the Greeks *Catacecaumanoi*, and in such kind of places. Since, therefore, springs of hot water

(*) This earth of Pozzuoli, is now called Pozzolana sand; it was first found in the neighbourhood of Pozzuoli, anciently called Puteoli, from whence it derived its ancient name Pulvere Puteolano; it is a kind of red earth very much resembling pounded bricks, or tiles; and, indeed, I have reason to believe, from my own experience, as well as

from the accounts I have received from others who have made the trial, that pounded bricks or tiles, as Vitruvius prescribes in the former chapter, being mixed with the lime and sand, and well beaten, will in a great measure answer the end of the Pozzolano sand.

are found in these places, fervid vapours arise in the caves of the mountains, and we know by tradition that these same countries were formerly overspread with fire, it cannot be doubted that the sand and earth are deprived of their moisture by the heat of fire, in the same manner as lime is in the furnace. These different and dissimilar things, therefore, being effected by the same acting power, receive a similar heat and dryness of nature; and upon being suddenly saturated with water, the latent heat occasioning a violent fermentation in the common mass, causes them to unite, and speedily acquire a consolidating property.

ONE question remains; viz. that since there are in Tuscany many hot-springs, how happens it that the earth which thus cements structures under the water, is not to be found there also? As this question requires an answer, the explanation must not be omitted. In all countries, the earth is not of the same nature, nor do the same kind of stones grow; in some places they are earthy, in others sandy, or gritty; in some, gravelly; and in others, of different and various qualities, according to the various properties of the earth: as, for example, it may be observed, that the countries of Italy and Tuscany, which are surrounded by the Appennine mountains, have no want of sand-pits near every part; but beyond the Appenines, on the side next the Adriatic sea, none are to be found; also in Achaia, Asia, and beyond sea, in general, they are unknown. So likewise, in all places where springs of hot water arise, the same properties may not concur, for they all proceed from the natural constitution of things; no ways depending on the will of men, but being fortuitously generated. Wherever, therefore, the mountains are not earthy, but are of a petrifiable kind of substance, the heat of the fire issuing forth through the interstices, endurates the parts, burning whatever is soft and inflammable, and leaving only what is hard and incombustible. As, therefore, in the Campania, the burnt earth becomes Pozzuoli sand; so in Tuscany, the soil is by heat turned to the carbuncle kind of sand; both are excellent for building, but one is most proper for structures on land, and the other for moles, and those which are built in the sea; the Tuscan soil is by nature softer than gravel, and harder than earth; wherefore, by the violent heat of the subterraneous vapours, which exhale in some places, the species of sand, called carbuncle, is there generated.

C H A P T E R VII.

Of Stone Quarries.

HAVING spoken of the several kinds of sand and lime, and also of their qualities, it follows next to treat of the quarries, from whence the hewn, as well as the rubble stones, for edifices, are extracted; these are found to be different and various in their nature; for some are soft, as the red kind near the city, and those of Pallienfis, Fidenæ and Albanæ; others are moderately hard, as the Tiburtine, Amiternine and Soractine; and some are very hard,

as are those of flint; there are also divers other kinds; as, in the Campania, the red and black gravel; in Umbria, Picæno, and Venice, the white stone, which may even be cut with a saw, like wood; but all the soft kinds, though they afford this conveniency, that the stones when extracted, are wrought with facility, and if situated under shelter, will answer the end; yet, if they are left uncovered, and exposed to the weather, they will be ruptured and dissolved by the frost and rain; also, if they are near the sea-coast, they will be corroded by the salts; neither will they bear heat.

ON the contrary, the Tibertine stones, and those of the same kind, will bear all the injuries of the weather, as well as the burthen laid upon them, but are not proof against fire; for, if they are heated by it, they split, and shiver to pieces; for they are naturally tempered of a small portion of water and earth, and much air and fire. When, therefore, they are exposed to the action of fire, the internal vapours being rarified and expelled, the fire easily enters the vacuities, burning, and giving their substance a similar degree of heat; but there are many stone quarries, on the confines of Tarquinium, called Anitianæ, of the colour of the Albanian, the pits laying chiefly about the Vulsinian lake^{1*}, in the prefecture of the Statonienfi, which are of an excellent quality, for neither frost nor fire can hurt them; and they endure, and remain sound to a great age; for they are naturally tempered of an equal portion of air and fire, a moderate quantity of water, and much earth; so that, being solid and compact, they suffer neither from the weather, nor the violence of fire. This is particularly proved by the monuments, near the town of Ferentum, which are built of these stones, and in which there are large statues excellently wrought, as well as smaller figures, flowers, and Acanthus leaves, elegantly carved; which, though old, appear as perfect as if lately made; the brass workers also, prepare their molds for founding, from the stone of this quarry, and find it exceeding serviceable: if it was near the city, it ought to be made use of in all works.^{2*}

BUT as their vicinity makes it necessary to use the quarries of red stone, and those of Pallienfis, which are near the city, it is proper to mention how these materials should be prepared.

WHEN an edifice is intended to be built, they should be extracted from the quarry two years before they are to be used; not in winter, but in summer; and must be left laying in uncovered places; those which, in the two years, have been injured by the weather, are used in the foundation; the others, which are not damaged, being thus proved by nature, will also remain unhurt, when they are laid in the superstructure. This method is to be observed not only in structures of hewn stone, but also in all cementitious buildings.^{3*}

(1*) Now called *Lago Bolseno*.

(2*) Tacitus informs us that Nero, after the fire which happened in his reign, ordered the houses to be

rebuilt with Alban and Gabian stone, which would endure the heat of fire unhurt.

(3*) Cementitious buildings are those wherein rubble stones or bricks, are used.

C H A P T E R VIII.

Of the several Sorts of Walls.

THE sorts of walls are, the reticulated, (FIG. VIII.) which is now generally used; and the antient, which is also called the incertain; (FIG. IX.) Of these two the reticulated is the handsomest, but the joints are so ordered, that in all parts, the courses have an infirm position; whereas, in the incertain, the materials rest firmly one upon the other, and are interwoven together; so that they are much stronger than the reticulated, though not so handsome; both sorts are formed of very small pieces, that the walls being saturated with mortar, may endure the longer; for the stones being of a porous and spongy nature, absorb the moisture from the mortar; and when there is an abundance of mortar, the wall having more humidity, will not so soon decay, but will on that account be rendered more durable; for, as soon as the humidity is extracted from the mortar by the suction of the stones, then the lime and sand separating, the cement is dissolved, and the mortar no longer uniting the materials, the walls soon become ruinous. This may be observed in some tombs near the city, which are built with marble, or hewn stone, and the internal parts rammed with rubble stones; the mortar being by length of time drained of its humidity by the suction of the stones, and the union of the joints being dissolved, they separate, and fall to ruin.

Fig. IX. To avoid this error, the middle space must be strengthened with abutments of the red hewn stone, or bricks, or common flints, built in walls two feet thick, and bound to the fronts with cramps of iron fixed with lead; for the work being thus built in a

(1*) In several parts of Italy there are walls of the reticulated kind yet standing, that were built in the time of the first Roman emperors; which is a sufficient proof of their strength and durability.

(2*) In the incertain sort of walls, I understand that the courses were always level, but that the upright joints were not ranged regularly, or perpendicular to each other in the alternate courses, nor in any other respect correspondently; but were disposed uncertainly, according as the accidental size, &c. of the stone, or brick, occasioned. Thus our bricks are commonly arranged in ordinary walls, in which all that is regarded, is, that the upright joints in two adjoining courses do not coincide. Perault believing that the word *incertum*, should be read *infertum*, thinks, that the stones were arranged in level courses, and corresponding upright joints, and that this sort was called *infertum*, only from the stones being inserted between each other. But I cannot be of this opinion, because in that case, this sort

would be as handsome as the reticulated sort, or more so; being the same manner in which Vitruvius, at the third chapter foregoing, says, the Roman and Greek bricks were disposed, and which he commends as being agreeable.

Nor can I think with Galiani, and some others, that in the incertain sort, the stones themselves were irregular, and were also placed disorderly, without any regard to horizontal courses, or perpendicular joints; because that arrangement would be less firm than the reticulated kind, which is directly contrary to the words of Vitruvius.

The manner I have conjectured is, at least, so far right, that it agrees with the words of the text, in being more firm, though less handsome than the reticulated, and also makes the word *imbricatus* agree with the sense of the passage, without reading it *implicatus*, as some have supposed it should be read; for it implies, that in the incertain manner the stones are laid in the same order as tiles are usually arranged, which is exactly the fact, according to my supposition.

regular manner, and not laid in promiscuous heaps, will remain without defect; and being by the orderly arrangement of the courses and joints firmly united and bound together, it will not be liable to fractures, nor will the abutments suffer it to fall to decay. For this reason, the walls of the Greeks are not to be despised; for though they do not use smooth, or polished materials, yet where they discontinue^{3*} the square stones, they lay the flints or common hard stones that they use, in the same manner as bricks are generally laid, binding the courses together with alternate joints, and thus make their works strong and durable.

THESE walls they build in two manners; one is called *Ifodomum*, (FIG. x.) the other *Pseudifodomum*, (FIG. xi.) *Ifodomum* is, when all the courses are of an equal thickness; and *Pseudifodomum*, when they are unequal: both these sorts are firm; first, because the stones themselves are of a compact and solid nature, and do not absorb the moisture from the mortar, but preserve its humidity to a great age; and, secondly, being situated in regular and level courses, the mortar is prevented from falling; and the whole thickness of the wall being united, it endures perpetually.

Fig. XII. ANOTHER sort is that which they call *Emplecton*, which is also used by our villagers. The faces of the stones in this kind, are smooth; the rest is left as it grows in the quarry, being secured with alternate joints and mortar; but our artificers quickly raising a shell, which serves for the faces of the wall, fill the middle with rubble and mortar; the walls, therefore, consist of three coats, two being the faces, and one the rubble core in the middle. But the Greeks do not build in that manner; they not only build the

Fig. XIII. facing courses regularly, but also use alternate joints thorough the whole thickness, not ramming the middle with rubble, but building it the same as the face, and of one united coat construct the wall; beside this, they dispose single pieces (A) which they call *Diatonos*, in the thickness of the wall, extending from one face to the other, which bind and exceedingly strengthen the walls. Those, therefore, who would build works of long duration, must attend to these rules, and make use of such methods of building; for the smooth polish, and beautiful appearance of the stones, will not prevent the wall from being ruined by age.^{4*} For this reason, when valuations are made of

(3*) Galiani translates this passage thus: *nelle fabriche che non richiedono pietre quadrate, adoprano Selce*: in buildings which do not require squared stones, the Greeks use flints, &c. I understand it differently; viz. that, in the middle part of the walls, where the square facing stones were discontinued, the Greeks used flints, &c. For it is plain that, Vitruvius here compares the Greek walls with the Roman, only in that single circumstance of which he is treating; viz. the manner of working the middle part of the wall; saying, that though the Greeks did not use smooth facing stones, yet, the internal part of their walls, where the square stones were omitted, and flints, &c. were used, they built in a better manner than the Romans did, not laying them in promiscuous heaps, but interweaving them together in the manner of bricks. See Fig. X. and XI. The words of the

text are, *sed cum discefferunt a quadrato, ponunt de silice, seu de lapide duro ordinarium & ita uti lateritia struentes alligant eorum alternis coriis coagmenta.*

(4*) The Roman *Emplecton*, Fig. XII. had a core of rubble stones in the middle, thrown in promiscuously; but the Greek *Emplecton*, Fig. XIII. was wrought throughout the whole thickness with stones, in the same manner as the facings, or fronts. The Roman *Emplecton* differed also from the Greek *Ifodomum*, and *Pseudifodomum*, in that these latter, though they had a core of rubble stones in the middle, yet, those rubble stones were interwoven together in the manner of bricks, and not laid promiscuously, as in the Roman walls. The Roman reticulated kind, I conclude, was the same throughout the whole thickness, as Vitruvius says nothing to the contrary, and speaks of no core in the middle.

common buildings^{5*}, the value is not fixed at the price for which they might be built; but finding from the records, their time of letting, an eightieth part of their original value is deducted for every year elapsed, and the remaining sum is adjudged to be the value of the building; it being the received opinion, that they cannot endure more than eighty years.

BUT as to buildings of brick, provided they stand perpendicularly, nothing is deducted; they are always estimated at the sum for which they might have been first built; in many cities, therefore, the public, as well as private buildings, and even palaces, are constructed with bricks; as, the walls of Athens, which look toward the mounts Hymettus and Pentelensis: the walls of the cells of the temples of Jupiter and of Hercules, are also built of bricks, the surrounding columns and epistylum being of stone; the ancient walls of Arezzo, in Italy, excellently wrought: the house built by the Attalic kings, at Tralles, which is always given for the habitation of those who bear the office of priests of the city: the paintings which were brought from Lacedæmon, were cut from walls of bricks, and conveyed in cases of wood, to ornament the Comitium, in the edileship of Varro and Murena: the house of Cræsus, which the citizens of Sardis converted into a college for the retirement of the aged: the mausoleum of the most potent king of Hallicarnassus, in which, though the ornaments were all of Proconnesian marble, the walls were built of bricks, which remain to this time exceedingly substantial; and the incrustation appears as polished and shining as glass. Nor was it to avoid expence that this king used bricks; for, as he commanded all Caria, his revenue was immense, and superfluous; but it was the result of his judgement and knowledge in building, as may from the following instance be concluded.

HE was born at Mylasso, but observing Hallicarnassus to be a place fortified by nature, well adapted for commerce, and having a commodious harbour, he there established his residence. This place is in the form of a theatre; the forum is situated at the bottom, near the port. At the top, in the middle of the curve, is formed an area, or square, of ample dimensions, in the midst of which stands the mausoleum, a building so excellent, that it is numbered amongst the seven wonders of the world. In the middle of the citadel above, is the temple of Mars, having the colossal statue which they call Acrolithon, made by the hand of the noble Telochares^{6*}, or, as some think, by Timotheus. The temple of Venus and Mercury is at the extremity of the right horn of the curve, near the fountain of Salmacis; of which, those who drink, according to a vulgar notion, become amorous: but the origin of this false report, which has spread over the whole world, must be related. It owed its rise to no property in the water producing effeminacy or unchastity; but to its transparency and

(5*) *Paries* may signify any structure; either a house, or a single wall; I have supposed it to signify the former, in this place; because it appears to me undoubtedly to be the meaning of Vitruvius; the rather, as he presently after mentions the time of letting, which cannot be supposed to allude to a single wall, but must refer to some kind of habitation, or dwelling.

This is one reason why I cannot follow the example of

Galiani, in translating the word *communis* exterior. See Note 7, Chap. I. Book I.

(6*) Vitruvius names one Leochares, in the preface of his seventh Book; and Pliny, Chap. V. Book XXXVI. mentions Leochares, a sculptor, who flourished under the reign of king Mausolus; from whence it is thought, that Telochares, here named, was the same person; the different spelling being very likely owing to the mistake of the copyists.

agreeable taste; for, when Melas, and Arivantias, conducted to this place a colony from Argos and Træzen, they expelled the savage Carians and Leleges; who flying to the mountains, there assembled together, making excursions, and continually plundering and waſting the country. Some time after, one of the colony, invited by the goodneſs of the water, ſettled a tavern near this fountain, for the purpoſe of gain, furniſhing it with all neceſſaries; this inticed thither the barbarians, who reſorting thither ſingly, and frequently meeting there in numbers, by degrees changed their rude and ferocious manners, for the cuſtoms and urbanity of the Greeks; and were thus voluntarily ſubjected. Hence the report aroſe; not from any effect of the water, but from its being the means of civilizing the minds of the barbarians. I now quit this ſubject, to return to the deſcription of the city, in which I was engaged.

As the temple of Venus, and the above mentioned fountain, ſtands on the right horn, ſo on the left, ſtands the royal palace, which king Mauſolus there judiciously ſituated. For on its right ſide, it commands the view of the forum, the port, and the whole compaſs of the city; on its left there is a ſecret port, ſo concealed by the mountains; that none can ſee or know what is there tranſacted; and the king himſelf could, from his palace, privately give his commands to his ſeamen and ſoldiers. After the death of Mauſolus, when his wife Arthemifia reigned, the Rhodians, filled with indignation that all the cities of Caria ſhould be governed by a woman, diſpatched a powerful fleet to take poſſeſſion of the kingdom; Arthemifia, hearing this, prepared a private ſquadron, well furniſhed with mariners and ſoldiers, and concealed them in this ſecret port; ordering the reſt of the citizens to guard the walls. When the pompous fleet of the Rhodians appeared before the greater port, ſhe commanded thoſe who guarded the walls, to ſeem to give them encouragement, and pretend that they would ſurrender the town; the deluded Rhodians having entered within the walls, and left their navy weakly defended, Arthemifia, unexpectedly opened a canal that had a communication with the ſea, brought the ſquadron out of the ſecret port into the greater, and the Rhodian fleet being abandoned by the mariners and ſoldiers, and left defenceleſs, ſhe drew it off to ſea. The Rhodians, therefore, having no place of retreat, and being ſurrounded on all ſides, were ſlain in the aforementioned forum. Arthemifia then embarked her rowers and mariners in the Rhodian veſſels, and ordered them to ſail to Rhodes: the Rhodians ſeeing their veſſels approach, decorated with laurel, believed their fellow citizens were returned victorious, and received the enemy. By this ſtratagem, Arthemifia ſurpriſed Rhodes; ſlew the principal men, and then raiſed a trophy of her victory in the miſt of the city; making two ſtatues of braſs, one repreſenting herſelf, and the other, the city of Rhodes, held by her in ſubjection. In after times, the Rhodians (as their religion forbade the removal of a conſecrated monument) erected a high wall around it, in the Greek manner, that the trophy might not be ſeen, and ordered it to be called *Abuton*.

As, therefore, ſuch great and potent princes did not diſdain to erect walls of bricks, whoſe revenues and ſpoils would have enabled them, to uſe not only rough, or hewn ſtones, but even marble; I think, edifices conſtructed of bricks, are not to be diſapproved, provided they are well executed. But bricks cannot be uſed by the Romans within the city; the

reason of which, I must not omit to explain. The laws permit no walls which are built in public places, to be of a greater thickness than one foot and a half; and to save room, other walls are made of the same thickness; but brick walls of a foot and a half thick, unless they contain the length of two or three bricks in that thickness, cannot sustain more than one story^{7*}; yet, the dignity of the city, and the multitude of citizens, requiring innumerable habitations, and, as the area of the city cannot contain so great a number as inhabit it; to remedy the deficiency, the height of buildings is increased. To this end, the walls are raised with hewn stone, testaceous substances^{8*}, or rubble, and built many stories high; thus making convenient apartments, both for repast and prospect; by means, therefore, of galleries, and multiplying the stories, the habitations are, without inconvenience, made sufficient, and suitable for the Roman people. Thus the reason is given, why, on account of the limited space of the city, it is necessary to prohibit walls of brick; whereas, without the city, buildings of brick may be so executed, as to endure firm to a great age.

THE tops of walls, just under the tiles, should be built of testaceous materials, for about the height of a foot and a half; and should have a projecting cornice, by which means the usual defect will be avoided; for, if the tiles of the roof happen to be broke, or blown off by the wind, and the rain water penetrates, this testaceous covering will prevent it from injuring the bricks, and the projecting cornice shelters, and by that means preserves, the walls from damage. Whether testaceous substances are defective or not, cannot at first be known; but if they remain sound, after having laid in the roof, and endured a winter and summer, they are good; for such as have not been made of good loam, or have not been sufficiently burnt, on being thus tried by the rain and frost, discover their imperfection. Those, therefore, that will not answer their purpose in the roof, cannot be firm enough to bear the weight of the walls; wherefore, walls built of old tiles, from a roof, will be the most substantial.

As to the hurdle walls, I wish they had never been thought on; for, however convenient they may be, on account of expedition, or for saving ground, they are, nevertheless, a great

(7*) To understand this passage, it is necessary to be here recollected, that the Roman bricks, called *Didoron*, were a foot and a half long, and a foot broad; consequently, if they had used these bricks in walls of a foot and a half thick, such walls being but one brick in thickness, must have been very weak; because the bricks could not have been interwoven and united together, or, as our workmen express it, they could have had no bond. Unless, therefore, (as Vitruvius intimates) their bricks had been made of such a size, that the length of two or three of them might have been contained in the thickness of the wall, the work could not have been sufficiently strong to have bore many stories.

Our laws have also limited the thickness of party walls to a foot and a half; not indeed with a similar intention, to prevent our making them too thick, which is not our propensity; but on the contrary, to prevent our making them too thin. Yet, we find our walls of a foot and a half thick,

strong enough to bear several stories; the reason of which is, that our bricks are so small, that the length of two of them may be contained in the thickness of the wall, and, therefore, they may be properly interwoven and bonded together.

(8*) It appears evident, that by testaceous substances, Vitruvius means tiles, or some sort of burnt earth, and not any kind of shells, as some have imagined; for, a little after, he says, it cannot at first be known whether they have been made of proper loam, or have been well burnt; and also speaks of walls built of tiles.

The whole of this chapter is very similar to the 14th chapter of the 35th book of Pliny, and it is very probable that one was copied from the other. See the Observations on the Life of Vitruvius.

and public evil; being as liable to take fire as faggots, purposely prepared; it is better to be at the cost of brick walls, than to save that expence by living in danger. In those which are plaistered, crevices are left perpendicularly and transversely; for, upon receiving the plaister, its humidity causes them to swell, and, as it dries, they contract; by which they break and destroy the texture of the incrustation; but, as some persons, on account of dispatch, or poverty, or to save ground, may be obliged to use them, they should build them in this manner. A footing should be built so high that the hurdles may be raised from the gravel and pavement; for, if they are sunk in the ground, they soon become rotten, and by settling downward, break the face of the plaistering.

HAVING treated of walls in general, and the preparation and properties of the materials of which they are constructed, in the best manner I have been able, I shall now speak of the floors, the materials of which they are formed, and the manner of preparing them, so that they may endure unimpaired a great length of time.

C H A P T E R IX.

Of Timber.

TIMBER may be felled, from the beginning of autumn, to the time when the wind Favonius begins to blow^{1*}; for, in the spring, all trees become pregnant, and put forth their annual fruit in the branches, according to their several natures; when, therefore, by the influence of the season, they are porous and humid, they are then rendered weak and useless. The bodies of women, when they have conceived, are not judged to be in health till after their delivery; neither are slaves, when pregnant, deemed sound; because in bodies that are breeding, the fœtus draws all the nourishment of the food to itself; and, as it encreases, and approaches nearer to the time of delivery, the less sound the generating body becomes; but when the fœtus is delivered, the nutriment which it before attracted to itself, is received by the exhausted and open vessels of the progenetrix, which absorbing the juices, the body is restored to its former natural sanity. For the same reason, at the season of autumn, when the fruits are ripe, and the branches grow flaccid, the roots receiving in themselves the juices of the earth, the trees are recovered and restored again to their former vigour; for they are compressed and consolidated by the force of the winter air: if, therefore, the timber is felled according to these rules, and at the time above written, it will be found the most proper season.

(1*) The wind Favonius was supposed to begin to blow about the eighth day of February. Pliny, book 16, chap. 25.

TREES are to be felled in this manner : they should be cut half through their thickness to the pith, and so left, that by discharging the sap they may grow dry ; for the emission of the useless juices from the pith, will prevent the timber from being corrupted by the retention of the putrid matter. Then when the tree is thoroughly dry, and drops no longer, it must be felled ; and being thus prepared, it will be fit for use. It may be observed that shrubs, at the proper time, become perforated at bottom ; and by means of those perforations, pour out from the pith their superfluous and vitiated juices, and thus drying, render themselves durable. In those which have not this efflux, the stagnating humours putrefy, and render them unsound and perishable. If, therefore, trees are found to be preserved by drying while they are standing and vegetating, without doubt they should be so treated when they are to be felled for timber ; for being prepared in that manner, they will remain in the building serviceable to a great age.

TREES are of various kinds, and have different properties ; as, the oak, the elm, the poplar, the cypress, the fir, &c. which are the kinds chiefly used in building. The oak has not the qualities of the fir, nor the cypress of the elm ; nor are any of the others alike in their qualities ; but each kind has a peculiar nature and mixture of the elements, and one or other will answer all purposes. In the first place, the fir has much air and fire, and little water and earth ; being therefore constituted of things of a light nature, the wood is not ponderous, is naturally rigid, and will not easily bend under its burthen, but will remain in the flooring, straight, and inflexible : this wood, however, having much heat, is apt to breed worms, which destroy itself. It also easily takes fire ; for being light, open, and aerial, it readily kindles, and emits a violent flame ; that part of it which is nearest the earth before it is felled, receiving most moisture on account of its proximity to the root, is rendered knotless, and most humid : on the contrary, the upper part, which, by reason of the fervent heat, is extended in the air in knotty branches, being cut at the height of twenty feet, and hewn smooth, is, from its knotty hardness, called *Fufterna* ; but the bottom part, when it is hewn and separated into four quarters, the sappy part being rejected, is reserved for the internal work, and called *Sapinus*^{2*}.

THE oak, having a superabundance of the element of earth, and very little water, air, and fire, when used in works in the ground, will endure for ever ; for being impervious and close, it, on account of its compactness, will admit no moisture into its substance ; but resisting and shunning the humidity, warps, and splits the work in which it is used. The *Esculus*^{3*}, which is equally compounded of all the elements, is of great use in building ; but if placed in water, the humidity entering its pores, and expelling the air and fire, makes it soon decay.

(2*) See Note 13. Chap. II. Book I.

(3*) I have mentioned this tree by its Latin name, for it is doubtful, what tree is to be understood by it ; some supposing it to be a beech, and some a species of oak, called

the holm ; but this latter is more generally supposed to be the Cerrus, which Vitruvius names afterward.

Pliny, in his Natural History, book 16. chap. 5. seems to speak of the *Esculus* as well as the *Cerrus*, as different species of oaks.

THE holm, the cork, and the beech, have an equal mixture of water, fire, and earth, but abound in air; being therefore porous, and easily permitting fluids to penetrate them, they soon perish.

THE white and black poplar, the willow, the lime, and the agnus castus, are replete with fire and air, have a moderate portion of water, and very little earth; they are therefore of a light temperature, and have a toughness which is found exceeding serviceable; for not being hardened by a large mixture of earth, and by reason of their rarity, being white, they are very manageable, and proper for carving.

THE alder, which grows near the banks of rivers, and is a wood not much used, has some excellent qualities; for being compounded of much air and fire, and a little portion of earth and water, its substance is not overcharged with moisture. Piles, therefore, of this wood, being drove in the foundation of edifices which are erected in marshy places, there imbibing the humid element of which their substance least partakes, will endure eternally, and support the most ponderous structures. This wood, therefore, which out of the earth can endure but a short time, will, if buried in a watery soil, last for ever. This may be chiefly observed at Ravenna, for there all buildings, as well public as private, have these kind of piles in their foundations.

THE elm, and the ash, having much water, little air and fire, and a moderate quantity of earth, are, by reason of their abundant humidity, too pliable, and easily bend under their burden; but when they become dry by age, or have arrived at that state of perfection in growing, the moisture within them being inactive and stagnant, they then become more tough, and from their flexible quality are very useful and strong in all cases where joinings are necessary.

THE maple likewise containing much air and water, and little fire and earth, is not brittle, but has a useful pliability. The Greeks, therefore, who make the yokes of oxen, called *zyga*, of this wood, name it *Zygian*.

NOR less to be valued are the cypress and pine, which have an abundance of water, and an equal mixture of the other elements; being therefore replete with moisture, if they are used when green, they are apt to split; but when old they remain long without defect; for the juice which is in their substance, has a bitter savour, and by its acrimony, suffers no worms, or any destructive vermin, to enter; for which reason, buildings constructed of these kinds of timber, endure an immense time.

THE cedar and juniper have the same virtues and uses; and, as from the cypress and pine comes resin, so from the cedar flows the oil which is called *Cedrium*; with which books, and other things, being anointed, are preserved from moths and worms; the leafage of these trees is like that of the cypress; and the fibres are straight. The statue in the temple of Diana, at Ephesus, is made of this wood; so also, on account of its durability, are the

Lacunariæ^{**} of that, and of many other magnificent temples. These trees grow chiefly in Crete, Africa, and in some parts of Syria.

THE larch tree, which is unknown, except to the inhabitants about the banks of the Po, and the shore of the Adriatic sea, is not only preserved from the rot, and worms, by an excessive bitter juice, but is also secure from fire; for it will not flame, but will only consume to a calx, as stones do in the furnace, by the means of other wood; nor will it even then burn, and become as a coal, but slowly, and after a long time will be consumed. The reason is, because it has in its substance very little of the elements of fire and air; but of water and earth, it is replete and full; and has no pores by which the fire may enter to dissolve its texture. This wood will not soon decay, and, on account of its ponderosity, water cannot sustain it; so that when it is to be transported, it is placed either in vessels, or on rafts of fir. The first discovery of this timber happened thus: when the army of the deified Cæsar was near the Alps, he commanded the inhabitants to shew him a safe passage, and to conduct him over those mountains; there was a fortified castle called Larignum, and those that were therein confiding in its natural strength, refused to obey his command: the emperor, therefore, ordered it to be attacked. Before the gate of the castle was a tower, constructed like a funeral pile, with beams of this wood placed alternately transverse, from the top of which they annoyed the assailants with stakes and stones; when it was observed that they had no other weapons than wooden darts, and that they could not throw them far from the walls, by reason of their weight, orders were given to approach with faggots and burning fascines, and pile them against the tower. The soldiers quickly obeyed, and the flames from the faggots ascending to a great height round the tower, made it believed that the whole mass was consumed; but when the fire abated, and was extinguished, the tower appeared unhurt. Cæsar, struck with admiration, then ordered it to be assaulted with the missile engines; upon which, the country people being affrighted, surrendered. It was then demanded of them, where this timber, which remained unhurt by fire, grew; and they shewed these trees, of which in that place there is a great abundance; from the castle of Larignum, therefore, this tree takes its name. This timber is brought by the river Po to Ravenna, to supply the colonies of Fano, Pesaro, Ancona, and the other municipal cities in that district: if it could conveniently be brought to Rome, it would be of great utility in building; for, in case it could not be used in all parts, at least it might be disposed in the projectures about the eaves of the insular buildings, and thereby greatly contribute to secure them from the danger of fire; for this wood will neither flame, nor will it burn like a coal. The leaves of this tree are like those of the pine; the timber is large; and for inside work, not less manageable than the Sappinus; it yields a liquid resin of the colour of Athenian honey, by which the phthific is cured.

THUS I have explained the several kinds of timber, and their properties; I shall next give the reason why that kind of fir, which at Rome is called Supernas, is worse than

(4*) The *Lacunariæ* are the pannels or coffers in the cieling, or in the soffites of the cornices, &c.

that called Infernas, which is exceeding durable, and shall explain the good and bad qualities they derive from the nature of the places where they grow, that they may be fully understood.

C H A P T E R X.

Of the Firs called Supernas, and Infernas.

THE Appenine mountains rising from the Tyrrhene sea, have their origin in the Alps, and in the extreme parts of Hetruria.* These mountains bend like a yoke, the middle of the curve almost touching the shore of the Adriatic sea, from whence they take their course toward the Straights. The nether side of these mountains, which looks toward the country of Hetruria, and the Campania, is of a warm nature; the sun incessantly shining on it the whole day; but the farther side, which declines toward the Adriatic sea, being turned to the northern regions, remains continually obscure, and in shadow. The trees, therefore, which grow on that side, being nourished by a humid soil, not only encrease to a great magnitude, but, from the abundance of moisture, have their pores saturated therewith; and when felled and hewn smooth, losing their vegetative property, and the toughness of their fibres altering as they dry, they, by reason of their porosity, become weak and perishing, so that they will not endure long; but those which grow in places exposed to the heat of the sun, being less porous, and their juices being extracted, are rendered more durable; for the sun not only absorbs the moisture from the earth, but exhales it from the trees also; those, therefore, which grow in the sunny parts, having their fibres close and compact, and not being rendered porous by too much humidity, will, when hewn into timber, remain long

(1*) Now called Tuscany, or rather the present Tuscany is part of Hetruria.

This passage has been differently rendered by the translators. They have been induced to think that the text erroneously describes the extent of the Appenines, to be from the Alps to that extreme of Tuscany next Rome, thereby implying that they extended no farther; whereas, it is well known that they extend from the Alps to the extremity of Italy, far beyond the confines of Tuscany, or limits of ancient Hetruria.

The text says, the Appenines have their origin in the Alps, and in the extreme parts of Hetruria; meaning (as I understand it) that extremity of Hetruria which is toward the Alps, not the other extremity toward Rome; Vitruvius, in that place, speaking only of their rise, not of their extent. In the next passage he speaks of their extent, saying, they

advance toward the Adriatic sea, and from thence bend their course toward the Straights; meaning, without doubt, the Straights of Messina, at the extremity of Italy, to which they really do extend, and where they terminate. So that the description, according to the text, is perfectly just. The words of the text are: *montis Appennini primæ radices ab Tyrrheno mari in Alpes & in extremas Hetruriæ regiones oriuntur, ejus verum montis jugum se circumagens media curvatura prope tangens oras maris Adriatici pertingit circuitibus contra Fretum.* By the words, *in extremas Hetruriæ*, has been generally understood, that extremity of Hetruria next Rome; which has been the source of the mistake. This is an unimportant matter; but as it has been generally misapprehended, and supposed to be an erroneous description, I thought proper to mention it. See Perault's Note on this Passage.

serviceable. This is the reason, therefore, that the fir called *Infernas*, which is brought from the sunny side, is preferable to that called *Supernas*, which comes from the shady side.

THUS much have I treated, as well as I have been able, of the materials necessary for the construction of buildings; of the elements of which they are observed to be constituted, and also of the several properties they possess, that they may not be unknown to those who build. Those, therefore, who follow these precepts, will, by properly adapting the several kinds of materials to their uses, be deemed the most skilful. The preparatives being now fully explained, I shall, in the following books, treat of buildings; and, firstly, as due order requires, of the symmetry and proportion of the sacred temples of the immortal Gods.

THE END OF THE SECOND BOOK.

T H E
A R C H I T E C T U R E

O F

M · VITRUVIUS · POLLIO.

B O O K T H E T H I R D .

P R O E M.

APOLLO of Delphos, by the voice of the priestess, pronounced Socrates to be the wisest of men. This wise and judicious man is reported to have said, that the human breast should have been open as a window, that the thoughts might not have been concealed, but have been exposed to observation; so, following his idea, I wish that all nature had been constituted open and apparent; that not only the virtues and vices of mankind might have been readily discerned, but also, that the knowledge of all sciences might have been evident to the senses; that no erroneous opinions might have prevailed, and all arts and erudition have been truly and perfectly comprehended. But as things are not thus constituted, and it is not possible to discover the capacity and knowledge which lays concealed in the minds of men; it therefore often happens that artists of great abilities, who are not rich, or have not become known by long business, or by recommendation, and are also unskilled in popular eloquence, cannot obtain by their works, the reputation of possessing so much merit, as those who are eminent are believed to possess.

Thus we may chiefly observe among the ancient statuaries and painters, who have gained commendation, and whose names will remain famous to the latest posterity; as Myron, Polycletus, Phydias, Lycippus, and others who have acquired reputation by their art; for they have obtained it by executing works for great cities, kings, or noble persons; while others, who have not been less ingenious and capable, and have performed excellent works for private and unknown persons, have obtained no fame; not for want of industry, or capacity, but of good fortune: such are Hellas, of Athens; Chion, of Corinth; Myagrus, of Phocis; Pharax, of Ephesus; Bedas, of Byzantium; and many others. Also among the painters, Aristomenes, of Thasos; Polycles, of Atracmitene; Nicomachus, and others,

who were neither deficient in industry, the knowledge of their art, or ingenuity; but either poverty, ill fortune, or being overcome in their pursuits by opponents, have impeded their success. Nor is it wonderful that, on account of people's ignorance of the arts, the meritorious should be neglected; but it raises our indignation when the interest of friends influences the judgment to a false preference. Wherefore, as Socrates said, if all thoughts, opinions, and knowledge, became visible and evident, neither favour nor interest would avail; but whosoever by real application and study became most capable, would be voluntarily employed. However, as things are not thus open and apparent, and I observe that the ignorant receive encouragement more frequently than the skilful, I judge it not proper to contend with the illiterate; but rather, by publishing these precepts, to manifest the usefulness of our art.*

IN the first book, therefore, O emperor, I have written of the art, its uses, and of the sciences an architect ought to understand; adding the reasons why he should be so qualified; I have also regulated the parts, and determined the limits of architecture: then, because it was most necessary, and first to be done, I have treated of the rules for choosing healthy situations; the manner of building the fortifications; of the several winds, and from what regions they blow; explaining the same by draughts; and also, of the commodious distribution of the streets and lanes within the walls; of all which the first book consists. In the second, I have written of the materials, their uses in buildings, and the properties they naturally possess. Now, in the third, I shall speak of the sacred temples of the immortal Gods, and of the manner in which they ought to be constructed.

(*) Vitruvius's description of his own time seems very justly to agree with the present. It is now usual for ignorance and interest to prevail over merit; it indeed seems to be the natural effect of things; for merit is naturally diffident and reserved, as ignorance (having nothing else to depend on) is necessarily assuming, and forward; and the latter qualities must generally prevail; because the majority of people cannot have so much knowledge in every art as is requisite to enable them to distinguish merit from inca-

capacity; for which reason they are obliged to form their opinion, on the pretences, appearances, or public fame of persons, or else are governed in their choice by interest and prejudice. If merit is preferred for its own sake, it is as much owing to the knowledge of the judges, as to the skill of the artist; for how should merit be preferred, unless it is perceived; and how should it be perceived, unless the judges have a sufficient knowledge of the art, to enable them to distinguish it?

C H A P T E R I.

Of the Composition and Symmetry of Temples.

THE composition of temples, is governed by the laws of symmetry ; which an architect ought well to understand ; this arises from proportion, which is called by the Greeks, *Analogia*. Proportion is the correspondence of the measures of all the parts of a work, and of the whole configuration, from which correspondence, symmetry is produced ; for a building cannot be well composed without the rules of symmetry and proportion ; nor unless the members, as in a well formed human body, have a perfect agreement. For nature has so composed the human body, that the face from the chin to the roots of the hair at the top of the forehead, is the tenth part of the whole height ; and the hand, from the joint to the extremity of the middle finger, is the same ; the head, from the chin to the crown, is an eighth part ; and it is the same from the bottom of the neck. From the summit of the breasts, to the roots of the hairs, is a sixth^{2*} ; and to the top of the head it is a fourth ; so also from the bottom of the chin to the bottom of the nostrils, is a third part of the height of the face ; the nose, from the bottom of the nostrils, to the middle of the eye-brows, is the same ; and from thence, to the roots of the hairs where the forehead ends, it is also a third part. The foot is a sixth part of the height of the body ; the arm^{3*} is a fourth ; the chest^{4*} is likewise a fourth ; the rest of the members have their measures also proportional ; this the ancient painters and statuaries strictly observed, and thereby gained universal applause. In like manner, the measures of the several parts of sacred edifices should have due correspondence to the magnitude of the whole. The central point of the body is the navel : for if a man was laid supine with his arms and legs extended, and a circle was drawn round him, the central foot of the compasses being placed over his navel, the extremities of his fingers and toes would touch the circumferent line ; and in the same manner as the body is adapted to

(1*) Vitruvius has also defined symmetry and proportion in the second chapter of the first book ; but his definitions here, as well as there, seem equally confused and unintelligible.

(2*) This cannot mean to the root of the hairs above the forehead ; for, if it is a fourth from the breast to the top of the head, it must be above a sixth from the breast to the top of the forehead. If it may be understood to the roots of the hair at the lower part of the face adjoining the ears, or at the neck, it will exactly agree ; the distance of those parts, from the breasts, being exactly a sixth part of the whole height of the body.

(3*) This means the cubitus, or arm, from the elbow to the end of the fingers.

(4*) The text has it *pectus*, which I have translated chest, rather than breast ; believing Vitruvius signifies by that word, the trunk of the body, from the breast to the lower part of the belly ; and which is a fourth part of the height of the body. For should I suppose that Vitruvius meant the breadth across the breast, as Galiani and others have done, it would be irreconcilable with the true proportion of the body : I am the rather inclined to be of this opinion, as Vitruvius has already described the upper part of the body above the breast ; and therefore may very naturally be supposed to speak now of the part below it.

the circle, it will also be found to agree with the square; for, if the measure from the bottom of the feet to the top of the head is taken, and applied to the arms extended, it will be found that the breadth is equal to the height, the same as in the area of a square.

SINCE, therefore, nature has so composed the human body, that the members are proportionate and consentaneous to the whole figure, with reason the ancients have determined, that in all perfect works, the several members must be exactly proportional to the whole object; and, as in all works they prescribe this method, so more especially in the temples of the Gods, in which the excellencies and faults remain for ever. The measures, which are necessarily used in all works, are also derived from the members of the human body; as, the digit^{5*}, the palm, the foot, and the cubit; these are divided into the perfect number, which the Greeks call *Telion*; for the ancients believed the perfect number to be that which is called *ten*; because *ten* is the number of the fingers of the hands: from the digit, the palm, and from the palm, the foot was invented.

ALSO as nature has formed ten fingers to the hands, Plato esteemed that number perfect; decads being produced by unities, which the Greeks call *Monades*. Advancing to eleven, or twelve, the numbers become imperfect, till they arrive at the next decad; for unities are the constituents of that number.

THE mathematicians, on the contrary, argue that the perfect number is that called *six*; because, according to their principles, it has six proportional divisions. Thus, one is the Sextant ($\frac{1}{6}$); two, is the Trient ($\frac{1}{3}$); three is the Semis ($\frac{1}{2}$); four, the Bes ($\frac{2}{3}$); which is called *Dimoiron*; five, the Quintarius ($\frac{5}{6}$), called *Pentamoiron*; six, the number perfect. Then counting upward, and adding one sixth, it is called *Ephecton*; eight, because it is the addition of a third, is the Tertiarius, which is called *Epititros*; nine, being the addition of the half, is the Sefquialter, called *Emiolios*; ten, is the Befalter, called *Epidimoiron*; the number eleven, being the addition of five, is the Quintarium Alterum, called *Epipentamoiron*; and twelve, because it is formed of twice the simple number, is called *Dyplasiona*.

MOREOVER, the foot of a man is the sixth part of his height; because, therefore, six times the measure of the foot terminates the height of the body, they establish it as the perfect number; observing also that the cubit, (or arm,) contains six palms, (or hands,) and twenty-four digits, (or fingers^{6*}.) As the cubit contains six palms, for that reason, it seems the cities

(5*) The digit is a finger's breadth, as the palm is a hand's breadth.

(6*) If the beauty, or agreeable effect resulting from the composition, or configuration of a work, principally depends on the proportion and symmetry of its parts, (as in my opinion it does,) and if any one number can be said to be better

adapted to produce that proportion and symmetry than another, it must be that whose integral parts are best suited to all the possible, or at least, proper proportions that may be used in any work. The number six has in this respect the preference of any other; not from any suppositions, or imaginary virtue, but for useful and positive power; for this number being formed by the union of the radix's of the

of Greece divided their drachm into six parts; for their drachm contains six equal pieces of brass coin, like the Assè, which they call Oboli, and each Obolus containing four Dichalcæ, or, as some call them; Trichalcæ, make twenty-four in a drachm; answering to the digits in a cubit; but we originally chose the former number *ten*; and constituted the Denarius; *Denos æreos*, of ten brass Assi^{7*}; which piece of money to this day retains the name of Denarius. The *Sestertius* also, which is a quarter part of a Denarius, was so called, because it contained two whole Assi, and half of the third Assè. But afterward, considering that both the numbers six and ten were perfect, we joined them together, and so made the most perfect number, *sixteen*; from hence arose the divisions of the foot; for, deducting two palms from the cubit, there remains four; and, as each palm contains four digits, the foot, of course contains sixteen; and just so many brass Assi are in the Denarius. Thus, all measures were derived from the members of the human body; and as the several members thereof have a proportional relation to the whole, so in the temples of the immortal Gods we should endeavour, that the parts of the work may be so regulated, that their proportion and symmetry, separately, and unitedly, may be conformable and correspondent.

THE principles of temples, which determine their aspect and figure, are these; first, IN ANTIS, which by the Greeks is called *Naos en parastasi*; then PROSTYLOS, AMPHIPROSTYLOS, PERIPTEROS, PSEUDODIPTEROS, DIPTEROS, and HYPÆTROS^{8*}; by which principles, the formations of temples are distinguished.

Fig. XIV. A temple is, IN ANTIS, when it has Antæ (D), in the front of the walls, which circumscribe the cell^{9*} (A); in the middle between the Antæ, two

duple and triple numbers, viz. 2 and 3, (which being multiplied together make six). It naturally becomes most easily resolvable into every other number, whether duple or triple; and consequently is most capable of agreeing with all proportions of what kind soever.

It may also be observed, that the ratio of all the musical concords are within the compass of a sixth; and the ratio, arising from the multiplication of all their numerators and denominators, is in its lowest term, as one, to six.

Neither can the senses distinguish with facility a division less than a sixth; the 8th, 10th, and 12th, are easy to distinguish, only by reason of their comparison with the 4th, 5th, and 6th.

Proportion is distinguished into arithmetical, geometrical, and harmonical; the first is, when a series of numbers in progression, have the same real difference; as 2, 4, 6, 8, 10, 12, &c. The second is when they have the same proportional differences; as 2, 4, 8, 16, 32, &c. The third is, when in three numbers, the first is to the third, as the difference between the first and second is to the difference between the second and third; as 6, 4, 3. Or, in four numbers, when the 1st is to the 4th, as the difference between the 1st and 2d is to the difference between the 3d and 4th; as, 4, 5, 6, 8. This latter kind of proportion, is that which

the concords of music bear to each other; as for example, 6, (the fundamental) is to 3, (the octave) as the difference between 6 and 4 (the fifth) is to the difference between 4 and 3.

Barbaro, in his notes, has launched out excessively in his remarks on the several kinds and variations of proportions; but I believe the hints I have here given, and the notes at Chap. I. Book I. will be found sufficient for an architect's attention and use.

(7*) The Denarius was originally divided into ten assi, but in the 485th year of Rome, an alteration took place, from which time it contained sixteen assi.

(8*) Most of these names are derived from *Stylus*, column; and *Pteron*, wing. Thus *Prostylos*, signifies having columns in front; *Amphiprostylos*, columns in both fronts; *Peripteros*, winged round, or having columns all round; *Dipteros*, double winged; and *Pseudo-dipteros*, false double winged; *Hypætros*, signifies uncovered; and *In Antis*, having at its ends, or pilasters.

(9*) The cell is the internal part, or chamber of the temple A, Fig. XIV, XVIII, &c.

columns (F); and the Fastigium^{10*} (E), placed above in the proportion which will be described in this book. An example of this is at the three temples of Fortune^{11*}, in that of the three which is next the gate Collina.

Fig. XIV. PROSTYLOS has all things the same as *In Antis*; but has also two columns (C), opposite the two angular Antæ (D), and the Epistylum^{12*} (I), above, in the same manner as *In Antis*; as also on the returns to the right and left^{13*}. An example of this, is in the temple of Jupiter, and of Faunus^{14*}, on the island in the Tiber.

Fig. XV. AMPHIPROSTYLOS, is the same as *Prostylos*; but has also columns, and a Fastigium in the Posticus (H), in the same manner.

Fig. XVIII. PERIPTEROS has, in the front, and in the Posticus, six columns; and in the flanks, eleven, including those at the angles; which columns are so disposed, that the distance of an intercolumn is left all round between the walls, and the extreme range of columns, forming a walk about the cell of the temple. Thus is the temple of Jupiter Stator, in the Porticus of Metellus^{15*}, which was designed by Hermodus^{16*}; and the Marian temple of Honour and Virtue, built by Mutius, without a Posticus^{17*}.

(10*) *Fastigium* is the word Vitruvius uses for the pediment, or angle of the roof. See E, in the Elevations of Fig. XIV, &c.

(11*) This alludes to a place in Rome where there were formerly three temples of Fortune.

(12*) Epistylum, in this place signifies the whole entablature, I, I, Fig. XIV.

(13*) The manner of expression here used, makes it doubtful whether the epistylum only, or the columns also, returned on the angles. The translators have understood it differently; but the latter manner is so impure and so foreign to the practice of the ancients, that I cannot hesitate in rejecting it.

(14*) Titus Livius, L. 34, S. 53, mentions the temples of Jupiter and of Faunus, as two distinct temples. Barbaro also describes that of Jupiter to be near the temple of Esculapius; and that of Faunus, at another part of the island; of this latter he says, "a few ruins were to be seen in his time, but which would soon be destroyed, as the Tiber continually washed away that point of the island on which they stood."

(15*) Livy mentions two temples of Jupiter Stator; one vowed by Romulus, the other by the consul Posthumus Megellus. Tacitus counts that built by Romulus, among

those buildings which were destroyed by the fire in Nero's reign. The translators have rendered this passage in such a manner, as to give us to understand that the porticus of Metellus was in the temple of Jupiter Stator, instead of the latter being in the former; and that the former was the example Vitruvius instances, instead of the latter. It was the custom of the ancients to build spacious walks and porticos about the temples, as we may learn from Chap. IX. of Book V. and from the fragments of the plan of Rome, now preserved in the Capitol: but it is without all authority, or probability, to suppose that the porticus of Metellus should have been inclosed within the temple, and that, so situated, it should have been a proper example of peripteral temples.

(16*) Some will have it that this should be read Hermodorus, because it is well known that there was an architect of that name, he being mentioned by sundry authors; whereas an architect of the name of Hermodus, is nowhere else mentioned. But as there may have been many able architects, whose names, or works, have not been transmitted to us, I think it not necessary to differ from the text.

(17*) There were in Rome several temples of Honour and Virtue; one of that name was built by Marius, in consequence of his victory over the Cimbri, which it is said he built in a very plain manner, having no taste for the arts. This, therefore, is probably the temple to which Vitruvius alludes.

Fig. XIX. PSEUDO-DIPTEROS has in the front and in the posticus eight columns, and in the flanks fifteen, including those of the angles. The walls of the cell correspond to the four middle columns of the front and of the posticus; so that the space of two intercolumns, and the thickness of one column, remains all round between the walls and the outer range of columns. No example of this is in Rome, but such is the temple of Diana at Magnesia, built by Hermogenes of Alabanda, and that of Apollo by Mnestæus.

Fig. XX. DIPTEROS is also octastyle^{18*} in the pronaos, and in the posticus, but has a double range of columns around the cell. Thus is the Doric temple of Quirinus,^{19*} and the Ionic temple of Diana at Ephesus, erected by Ctesiphonte.^{20*}

Fig. XXI. HYPÆTHROS is decastyle both in the pronaos and posticus; in all other respects it is the same as dipteros, except that in the inner part also it has columns (F); two rows in the height, detached from the walls all round, like the peristyle of a portico. Also the middle part (A) is left uncovered, and without a roof, and doors (C C) open both to the pronaos and to the posticus. Of this there is no example in Rome; but such is, at Athens, the octastyle temple, and that of Jupiter Olympius.^{21*}

(18*) Octastylus signifies having eight columns; decastylus, ten columns; hexastylus, six; and tetraastylus four columns in the front.

(19*) The pronaos is the porch or porticus in front of the temple, as the posticus is that in the back front.

(20*) There were two temples of Quirinus at Rome; one on the hill of that name; the other on the Via Appia, without the city. It is said, that which was within the city was always kept shut, to denote the secret and unknown end of Romulus, who after his deification was called Quirinus.

(21*) This name is variously wrote, as, Cresophon, Chrysyphon, Chresiphon, Chtesiphone, and Chersiphon. In the preface to the seventh book, and at the sixth chapter of the tenth book, Metagenes his son is also mentioned with him, as architect to the temple of Diana at Ephesus.

(22*) *Sed Athenis octastylus, & in templo Jovis Olympii*, are the words of the text, which I have rendered, *The octastyle temple at Athens, and that of Jupiter Olympius*; for it is not certain that we are to understand the word *octastylus* to relate to the temple of Jupiter Olympius, thereby determining that temple to be octastyle, as all the translators have generally understood. On the contrary, it appears to me, that Vitruvius means some other temple by the word *octastylus*; for he distinguishes it from *in templo Jovis Olympii*, by an (&), as I find by Galiani's edition of the text, and by all the manuscripts I have seen. There is also a similar passage just below. *Divi Julii & in Caesaris foro Veneris*, in which the distinction between the two temples is made by the same sign, (&) and which the same translators have all allowed to express different temples; rendering it *the temple of the divine Julius, and that of Venus in Caesar's forum*; although they might, with as much reason, have rendered this, *the temple of Venus in the forum of the divine Julius Caesar*.

Thus much I had written when I saw the controversy between Mr. Stuart and Mr. Le Roi, concerning the temple of Jupiter Olympius. I need not mention the several reasons that might be alledged, why Vitruvius could not distinguish this temple any otherwise than by the number of columns in its front, or that it was sufficient so to do; but will only mention some circumstances, which make it probable that the temple of Jupiter Olympius was a decastyle temple.

Among the present ruins of Athens are seventeen Corinthian columns, (commonly called *the columns of Adrian*), which Mr. Stuart, in his *Antiquities of Athens*, notwithstanding the answer of Le Roi, has given sufficient reasons to believe are the remains of the temple of Jupiter Olympius; they stand on the spot assigned by the ancient writers to that temple.

These seventeen columns are so disposed, that the longitudinal distance of the two most remote from each other is that of nineteen intercolumns, and their intermediate columns; so that this temple must have had twenty columns in flank.

This circumstance sufficiently evinces that the front must certainly have had ten columns; for if there had been no more than eight in front, there should have been but fifteen in flank, according to Vitruvius's principles; and but seventeen according to the custom of the Greeks, who usually placed in the flank one column more than double the number of those in the front.

If therefore these columns are truly the remains of the temple of Jupiter Olympius, we cannot doubt of its having been a decastyle temple; and consequently, that the word *octastylus* does not allude to that, but to some other Athenian temple.

C H A P T E R II.

Of the Five Species of Temples.

THE species of temples are five, which are thus named; **PYCNOSTYLOS**, which has columns very close; **SYSTYLOS**, a little more apart; **DIASTYLOS**, an ample distance; **AREOSTYLOS**, more distant than is proper; and **EUSTYLOS**, the just distribution of the intercolumns. **PYCNOSTYLOS** is that in whose intercolumns the thickness of one column and a half may be contained. In this manner is the temple of the deified Julius, and that of Venus in Cæsar's forum. There are also several others thus composed. **SYSTYLOS** is that in whose intercolumns the thickness of two columns may be contained, and the plinths of the bases are equal to the space which is between two plinths.^{1*} Thus is the temple of Equestrian Fortune, near the Stone Theatre; and several others are built in the same manner. Both these kinds are incommodious; for when the mothers of families, going to their supplications, have ascended the steps, they cannot pass arm in arm through the intercolumns, unless they pass side-ways. The closeness of the columns also obstructs the view of the door of the temple, and obscures the ornaments; and the walks about the cell are inconvenient, by reason of their narrowness.

Fig. XIV. and XV. **DIASTYLOS** is that disposition, in whose intercolumns the thickness of three columns may be placed. Thus is the temple of Apollo and Diana. This disposition is attended with some inconvenience; for the Epistylum, on account of the width of the intercolumns, is liable to break.

Fig. XXXI. IN **ARÆOSTYLOS**, neither stone nor marble Epistylia can be used, but beams of durable timber must be applied. The species of these temples are called *Barycæ Barycephalæ*,^{2*} low and broad; and the ornaments of their fastigiums are of fictile ware, or of brass gilt in the Tuscan manner. Thus, at the Circus Maximus, is the temple of Ceres, the Pompeian temple of Hercules, and also that of the Capitol.^{3*}

(1*) Consequently the projection of the base will be a quarter of the diameter of the column, which is much greater than is usually allowed by the modern masters, who, in general, allow the projection to be no more than the sixth part of a diameter, or thereabout. See *Fig. XXV. No. 1. and 2.*

(2*) From the Greek words, *βαρὺς*, low or flat, and *κεφαλή*, head.

(3*) Perault translates this passage thus: *aux temple de Ceres et d'Hercule, qui sont proche le grand cirque, et au Capi-*

tole, qui est en la ville de Pompei. The text is, *Uti est ad Circum Maximum Cereris, et Herculis Pompeiani, item Capitolii.* My translation agrees nearly with that of Galiani; for Pliny informs us, that there was a temple of Hercules built by Pompey, near the Circus Maximus; as also a temple of Ceres near the same: and Livy, in several places, mentions a temple of Hercules in the Capitol. The Tuscan temple, *Fig. XXXI.* is an example of this species, excepting that the columns are there but seven diameters high, whereas in *Areostylos* they are directed to be eight.

Now, returning to the EUSTYLE manner, which is the most perfect, and best suited to the purposes of convenience, beauty, and strength; the space of the intercolumns is made equal to the thickness of two columns and a quarter; and one intercolumn in the middle of the front, and another in the posticus, is equal to the thickness of three columns. Thus the aspect will be handsome, the access free from impediment, and the walk about the cell commodious. This species is thus regulated: The place designed for the front, if the temple is to be made tetrastyle, is divided into eleven parts and a half, exclusive of the footings, and the projecture of the bases. If it is to be of six columns, it is divided into eighteen parts; and if designed to be octastyle, into twenty-four and a half. By these divisions, whether it is tetrastyle, hexastyle, or octastyle, one part will be a module, and one module will make the thickness of the columns. Each intercolumn, excepting the middle one, has two modules and a quarter; the middle one of the front and of the posticus has three modules; and the heights of the same columns are to be eight modules and a half: so that, by these divisions, the intercolumns will be justly adapted to the heights of the columns. We have no example of this species in Rome; but such is the octastyle temple of Bacchus at Teos, in Asia.^{4*} This symmetry was established by Hermogenes, who also first invented the principle of the octastyle pseudodipteros; for, in the dipteral temples he suppressed the interior range of columns, in number XXXVIII.^{6*} and thus lessened both the expence and the labour. This made the walk about the cell exceedingly spacious, and in nothing impaired the aspect; so that, without the aid of the superfluous columns, the dignity of the whole work was preserved; for the pteromatos,^{7*} and the disposition of columns about the temple, was contrived solely to the end that the aspect might be enriched by the asperity^{8*}

(4*) Some remains of this temple are now published in the *Ionian Antiquities*.

(5*) Symmetry is here used in the sense in which species was before used. I have nevertheless chose to give the word of the text, that the reader may observe the different application of the words.

(6*) The manuscripts in general have XXXVIII. but it is believed to be an error of the copyists, and that it should have been written XXXIII. that being the number of columns in the interior range, as will be easily seen in referring to the draughts, Fig. XIX. and XX. I cannot imagine any more probable way of agreeing with the number of the text, than by supposing the two columns between the Antæ in the pronaos, and the two in the posticus, (marked 1, 2, 3, 4) were also suppressed, which, added to those of the inner range, will then make up the number thirty-eight. This may not be thought improbable, when it is considered, that the suppression of these four columns corresponds with the intention, and promotes the end designed, by suppressing the whole inner range of columns, (*i. e.*) opening and enlarging the walks about the temple.

Le Roi, in his *Ruins of Greece*, accounts for it in another manner, which has some probability. With the Greeks it was a general rule to make the number of columns in the flanks of their temples one more than double the number of those in the fronts; so that where there were eight in front, there were seventeen in flank; from whence it happened, that the columns in the interior range of Grecian dipteral temples were in number exactly thirty-eight.

The only objection to this supposition is, that Vitruvius has before described but fifteen columns in the flanks of dipteral temples; and it may be supposed he alludes to those temples, according to his own description, and the manner of the Romans, rather than according to the Greek manner, of which he has before taken no notice.

(7*) Pteromatos, see note 14, chap. vii. book IV.

(8*) Asperity is a term Vitruvius uses to express the frequency and intermission of the columns and intercolumns. Its application may be owing to the analogy there is between column and space, and the intermission of substance and space, which is the cause of the asperity or roughness of bodies. The French now use the word *asprette* as a common technical term.

of the intercolumns; also, if a number of people should be detained there by violent rains, they may wait in the temple, and about the cell, without inconvenience. This is the disposition of pseudodipteral temples: by which it appears that Hermogenes made a great and ingenious improvement, and has left an example from whence posterity may deduce the principles of the science.

The columns of Areostyle temples are so formed, that their thickness may be the eighth part of their height. In Dyastyle the height of the columns is divided into eight parts and a half, and one part is given to the thickness. In Systyle, the height is divided into nine parts and a half, of which one is given to the thickness of the column. In Pycnostylos, the height is divided into ten parts, and one makes the thickness of the column. But the columns of Eustyle temples, like those of the Dyastyle kind, are divided into eight parts and a half, and one part constitutes the thickness of the shaft at bottom. Thus the columns will be proportioned to the intercolumns; for, as the distances between the columns increase, so the thickness of their shafts should be increased in proportion; for if, in the Areostyle species, the thickness of the columns should be no more than a ninth or tenth part of their height, they would appear too thin and slender^{9*}; because, on account of the width of the intercolumns, the air lessens and diminishes, in appearance, the thickness of their shafts. On the contrary, if in pycnostylos, the columns should have in thickness an eighth part of their height, they would, by reason of the closeness and narrowness of the intercolumns, have a swollen and

(9*) Galiani, quoting Perault, remarks, that as there is the difference of a whole diameter between the height of dyastyle and systyle columns, and as the eustyle ranks between those two species, that the height of eustyle columns should also be in a mean proportion between both, and be nine diameters high, instead of being eight and a half.

This remark may be carried farther yet, and it may be hinted, that the eustyle intercolumns may likewise be two and a half diameters, as the mean between those of the dyastyle and systyle, instead of two and a quarter, which is nearer to the systyle: for it may be observed, that, notwithstanding Vitruvius says, the thickness of the columns should be proportional to their intercolumns, yet in the eustyle species, the intercolumns (as prescribed by him) incline most to the systyle, although the thicknesses of the columns are wholly the same as the dyastyle. It might therefore be no bad regulation in the eustyle species, to make the width of the intercolumns, as well as the proportional thickness of the columns, in the mean between those of the dyastyle and systyle species; that is, the intercolumns two and a half diameters of the column, and the columns nine diameters high. From this passage, as well as from the ninth chapter of the fifth book, and elsewhere, we may collect, that, among the ancients, it was not the order, whether Doric, Ionic, or Corinthian, that determined the proportional magnitudes of the columns and their several members, but the species of intercolumniation made use of; and which latter was governed by the destination, situation, magnitude, and other circumstances of the work. Vitruvius indeed fixes

the height of Ionic columns to eight and a half diameters, the Doric to seven diameters, and the Corinthian to nine and one sixth, where he treats of them separately; yet, when he speaks of their use in areostyle, dyastyle, and systyle work, he determines their proportion by the species of intercolumniation; and the proportion of their members, by their height, magnitude, place, &c. He also speaks of the use of the Doric order in systyle and dyastyle work, in which the columns must be nine and a half, and eight and a half diameters high, notwithstanding he gives but seven diameters to that order elsewhere.

Wherefore, in the examples antiquity has left us, we find Doric, Ionic, and Corinthian columns, and their members, of various proportions. In vain then do we seek to discover the principles which governed the ancients in proportioning their works, by comparing the several examples of the orders which they have left, when the order was not the circumstance by which they determined their proportions; and in vain, therefore, do we endeavour to fix the proportions of parts, which never ought to be fixed or limited.

To enable us to make any probable inferences concerning the principles which determined the ancients in the choice of their proportions in any given example, we should be acquainted with the destination, situation, and other circumstances of the work, as at its first erection; without which, the dimensions and proportions only will be useless, and our conclusions must be uncertain, if not erroneous.

deformed appearance; for symmetry ought to be observed in all kinds of work. The columns at the angles are also made a fiftieth part of a diameter thicker than the others; because they, being more surrounded by the air, appear more slender: the deficiencies of the flight must therefore be rectified by the judgment.

Fig. XXII. The diminution of the top of the column, at the hypotrachelium^{10*} (h), is thus regulated: If the column (a b) is not less than fifteen feet high, the thickness at bottom is divided into six parts, and five of those parts are given to the thickness at the top. If the height is from fifteen to twenty feet, the bottom of the shaft is divided into six parts and a half, and five and a half of those parts make the thickness of the column at the top. If it is from twenty to thirty feet, the bottom is divided into seven parts, and six of these make the diminution at the top. If it is from thirty to forty feet high, the bottom thickness is divided into seven parts and a half, of which six and a half is the measure for the diminution at the top. If it is from forty to fifty feet, it is divided into eight parts, whereof seven make the thickness of the hypotrachelium at the top of the shaft. And, if it is still higher, the same proportional method is to be observed; for, as a greater height causes them to appear more diminished, they are therefore to be corrected by an addition of thickness; beauty being the province of the eye, which, if not satisfied by the due proportion and augmentation of the members, correcting apparent deficiencies with proper additions, the aspect will appear coarse and displeasing. Concerning the augmentation that is made in the middle of columns, which by the Greeks is called *Entasis*, the manner of forming it just and gradual is shewn by the draught at the end of the book.^{11*}

(10*) The Hypotrachelium is the neck or upper part of the shaft of the column.

(11*) This draught, with all the others which Vitruvius annexed to his book, are lost; we are therefore left unacquainted with the method the ancients used, in forming the swell or *Entasis* of columns. All the commentators have taken it for granted, that Vitruvius intended the swell to be beyond the perpendicular of the bottom of the shaft, thereby making the column thicker in the middle than at the bottom; and it seems not to have occurred to them, that he might possibly mean, that the swell should rise from the inclined line that passes from the bottom of the shaft to the point of diminution at the top; although this latter is as consonant to the text as the former, and is much more beautiful and conformable to the antique: they have therefore charged Vitruvius with inculcating a rule, which neither propriety, beauty, or the example of antiquity, recommends; and which gives the column so deformed and displeasing an appearance, that few architects, if any, have thought proper to practise it.

Vitruvius has just told us, that columns are less at the top than at the bottom; consequently a column, in his sense, is a conical, not a cylindrical body. When, therefore, he

says columns have such a quantity of swell in the middle, he must mean that that conical body has such a swell, or that the swell is from the conical or inclined line; and cannot mean from a cylindrical or perpendicular line, which he nowhere describes. If he had described columns to be cylindrical, then the cylindric or perpendicular line must have been understood; but, as he describes them to be conical bodies, his words admit no other than the conical or inclined line to be accepted.

In many ancient columns yet remaining, we find the line which passes from the bottom to the point of diminution at the top, to be quite straight; but in the greater part of those in the Roman buildings, that line is observed to have a gentle swell or curvature; such, in fact, as columns would have, were they formed according to the supposition that the swell described is to be understood to rise from the aforesaid inclined line (a b, fig. XXII.) and not from the perpendicular line (a o). Reason, beauty, and the example of antiquity, therefore, all conspiring to support this opinion, as much as to disprove the other, it becomes more than probable that this was the meaning of Vitruvius.

From a passage at the end of this book we learn, that the quantity of the swell or *entasis* in the middle of columns is equal to the size of one of the fillets between the channels.

C H A P T E R III.

Of the Foundations, and of the Columns and their Ornaments.

FOR the foundation of these works, the ground must be dug down to the solid earth, and in the solid so far as seems needful for the magnitude of the building. The substructure must be made extremely strong. The walls above ground, under the columns, are made thicker by half than the columns which rest upon them, that the inferior may be stronger than the superior, and that the bases may not project beyond their support. These walls are called *Stereobatæ*, because they sustain the whole weight. The thickness of the walls above must also be wrought in the same manner, and the interval either vaulted or made solid by piling, whichever may be best approved. But if the place is found to be infirm, soft, and marshy to the bottom, then it must be dug and emptied, and piles of alder, olive, or oak scorched, driven in by machines very close together, and the intervals of the piles rammed with coal; after which the substructure is to be completed in the most compact manner.

Fig. XVIII. The foundation being raised, the stylobatæ (g) are all placed on a level, erecting the columns upon the stylobatæ, either in the pycnostyle, systyle, diastyle, or eustyle manner, as before described and determined. In the areostyle manner they may be disposed at pleasure. In peripteros the columns are so ordered, that as many intercolumns as there are in front, twice so many of the same intercolumns are made in the flanks; and thus the length of the work will be double its breadth. Those who make the number of columns double, mistake; because, in that case, the length will be one intercolumn too much.^{2*}

The channels, as well as fillets, are usually twenty-four in number, and the latter are to the former as one to three; one fillet must therefore be equal to the ninety-sixth part of the circumference of the column, or about the thirtieth part of the diameter, which therefore must be the quantity of the swell in the middle of the shaft.

The method of describing it may be as follows. A straight line (a b fig. XXII.) being drawn from the bottom of the shaft to the point of diminution at top, that line is divided, and at the middle the quantity (c p) of the swell is marked off outwardly; a regular curve, or portion of a circle, is then drawn, passing through those three points, the bottom (a), the top (b), and the entasis in the middle (p).

(1*) Vitruvius has before mentioned, that the bases project a quarter of a diameter of the column beyond the shaft; so

that the projection of the base on both sides, added to the diameter of the column, is equal to one diameter and a half of the said column.

(2*) All the commentators have observed, that if the number of intercolumns in front are doubled, the length of the temple will not even then be exactly twice its breadth, but will be one diameter of a column short of twice its breadth. This is true, if we measure to the outsides of the columns both ways; but if we reckon from the centers of the columns either way, which seems to be Vitruvius's intention, his rule is perfectly just, and agrees, in this respect, with the ancient temple of Concord at Rome, and that of Nîmes in France. The Greeks differed from the Romans in this matter, and generally placed in the flanks of their temples one column more than double the number of those in the front.

THE steps (h) in front are so contrived, that they may be always of an odd number, that the right foot ascending the first step, may also be first placed on the pavement of the temple. The size of the steps, I judge, should be such, that they may not be thicker than the dextant, nor thinner than the dodrant^{3*}; for, in that case, the ascent will not be tiresome. The breadth of the steps is made not less than a foot and a half, nor more than two feet. If steps are disposed all round the temple, the same rules should be followed; but if a podium is made round three sides of the temple, it is so formed, that its plinth (l), base (o), dye (r), corona (s), and lysis^{5*}, may agree with the same stylobata which is under the bases of the columns^{6*}.

THE stylobatæ should be wrought in such a manner, as to leave in the middle the adjection for the unequal scamilli; for, if directed level, it will seem to the eye to be channelled. But

(3*) The dextant is the five sixths of any measure, as the dodrant is the three fourths. Galiani argues on it as a doubtful matter, whether we are here to understand them to be parts of a foot or of a palm. I cannot have a doubt but that they should be understood to be parts of the foot; because Vitruvius, immediately after, gives the breadth of the steps in feet; and it is not very probable that he would give the thickness in one measure, and the breadth immediately after in another: besides, the Roman palm, being only a quarter of a foot, was too small a measure to admit a supposition that the ancient steps were so diminutive as to be a portion thereof. The Roman foot was eleven six tenths of our foot; consequently the dextant of their foot was a little short of ten inches of our measure, and the dodrant a little short of nine inches. The ancient steps, therefore, were much higher and broader than those now used by the moderns. In one of the ancient temples still remaining at Athens, the steps are of the measure here assigned; and in the remains of some temples at Pestum in Italy, they are much larger.

Perault has accepted the word *retractions* for the landings between the steps, which here only signifies the breadth or tread of the steps, as Galiani sufficiently evinces and corrects.

(4*) The Podium is the continuation of the pedestal through the intercolumns, or, as we call it, the *Dado*.

(5*) It is not agreed on, what member Vitruvius means by the word *lysis*; he uses it again at chap. vii. book V. and at chap. xi. book VI. at which last place he applies it to fractures in buildings. To judge from the order in which the parts of the stylobatæ are named, it should be some member above the corona; and may therefore be the ogee or cymatium, or, as some think, the weathering or slope above the cymatium, which lays on the corona.

(6*) Galiani explains this passage, by supposing, that the stylobatæ were raised above the pavement of the temple; but that was very rarely practised by the ancients, as is evident from the examples which have come to our knowledge. The tops of the stylobatæ were usually no higher than the pavement of the temple, and the height of the steps determined the height of the stylobatæ.

Vitruvius speaks of temples that had steps all round, and of another kind that had steps only in front, with a continued podium round the other three sides. As in this latter case there appears no occasion for stylobatæ, because the podium is the support of the columns, and as Vitruvius has mentioned stylobatæ under the columns, besides mentioning the podium, Galiani has been induced to believe, that Vitruvius alluded to an instance where the stylobatæ were raised upon the pavement of the temple, and above the top of the steps: but the fact is, as we may gather from the context, that stylobatæ were always first built under the columns, whether the temple was to be encompassed with a podium, or with steps; in the latter case, they were only plain square piers, hidden by the steps; in the former, they had their *quadrate*, *spire*, and *corona*, on the outer part. The podium walls were afterwards built between them, flush outwardly, but not inwardly; it not being necessary to make the podium so thick as the stylobatæ which supported the columns; and these podium walls had, as Vitruvius says, their plinth, base, corona, &c. corresponding with those on the external part of the stylobatæ. This is confirmed by an ancient temple at Cora in Italy, where the stylobatæ under the columns still remain, although the podium that was built between them is fallen; and which stylobatæ appear to have been built of stones suited to their own dimensions, and unconnected with the adjoining podium.

the manner of properly forming these scamilli will be shewn by the figure and description at the end of the book.^{7*}

(7*) This passage concerning the scamilli is universally allowed to be one of the most obscure and unintelligible parts of the whole work, and has much employed the thoughts of the translators and commentators of this author to explain. Baldus has written a treatise, intitled *Scamillos impares*, purposely to explain it. He supposes the scamilli to be subplinths, situated under the ordinary plinths of the bases of the columns, forming a double plinth under the same, as is seen in the temple of Fortuna Virilis at Rome. Baptista Bertanus supposes them to be projections in the dye of the stylobatæ, like the several faces of the architrave, and to which they also answer in the perpendicular. Some have thought the stylobatæ to have a protuberance in the middle of the face or dye, like the swelling of a circular frise; and others suppose the scamilli to be nothing more than the projections of the podium under each column, forming a stylobata to every column, instead of one continued and uninterrupted podium; and they account for the appearance of channellings, which Vitruvius speaks of, by supposing the recesses, which are formed by the alternate projection and recess of the podium, to be the channelling meant; or else that the dye itself is the channel, as being sunk between the projection of the capping and base mouldings. But it was not the practice of the ancients to make such breaks in the podium of temples, as has before been noticed; and the other suppositions are so foreign to the ancient manner, that they are far from being satisfactory, or even plausible.

The order Vitruvius observes in mentioning the several parts of the fabric, beginning from the foundation, and rising part by part, as they are situated next in height, is a powerful, and, I could almost say, incontestible, argument, to prove, that the scamilli are situated between the tops of the stylobatæ and bottoms of the bases of the columns; and the meaning of the word scamillus, which is that of a little bearer, footstool, or riser, intimates that they are some kind of bearer, upon which the columns may stand, so far agreeing with the supposition of Baldus. Vitruvius gives us to understand, that they are an addition in the middle of the stylobatæ, or, more strictly, that the addition is left for them, and that regard must be had thereto in working or levelling the stylobatæ, so as to leave that addition; but he does not say whether this addition is to be in the middle of the top, or of the front, or of the side, &c. However, the argument before mentioned sufficiently evinces, that it is the middle of the top or horizontal surface which is meant.

Another circumstance Vitruvius mentions concerning them is, that if this top of the stylobatæ is made level or strait, it will seem to be channelled or grooved. Here the supposition of Baldus fails: it cannot appear channelled, however the top of the stylobatæ may be wrought; nor does it agree in the inequality or dissimilarity which Vitruvius ascribes to the scamilli, calling them *scamillos impares*. These circumstances, and a passage farther on, which men-

tions some relation the scamilli have to the epistylum or architrave, are the great obstacles and difficulties of the solution.

There might be several devices, very different to each other, offered, that would agree with the circumstances of the description more or less aptly; but the description itself is not sufficiently explicit to enable us to determine on any one with certainty; and no antique example has yet been noticed that can assist us in the investigation. As one of the most probable, out of many, which have occurred to me, and as it differs from all others that have been offered for explaining this difficulty, I mention the following, leaving it to the world to decide on its probability or value.

I have before assented to the opinion of Baldus so far as to allow the scamillus to be a rising or adjection on the level top of the stylobatæ; but I do not agree with him in supposing it to be a subplinth. My notion is, that it is a small rising, scarcely so high as one of the fillets of the base is thick, and its measure horizontally something less than the square of the plinth of the base which rests on it, as (m, n, fig. XXII.)

With regard to the use of this rising, or scamillus, I suppose it to be the same as that similar small rising or adjection (i, k), usually found between the capital and architrave, in many of the ancient buildings; viz. to prevent rupturing the edges of the base, to correct the minute inequalities in the heights of the columns, so as to preserve the level of the epistylum, and to give the columns on the flanks that inclination inward which Vitruvius directs; for it is to be expected as unavoidable, that, in working so great a number of columns as were placed around peripteral temples, some small inequalities of height would happen, especially in cases where the columns were wrought at the quarry, at a great distance from the building, as was often the case.

To such purposes such adjections or scamilli were perfectly adapted, and may even be said to be necessary, and they will answer to every circumstance of the description.

For, 1st, With regard to their inequality or dissimilarity, these adjections on the stylobatæ being left sufficiently high, and afterwards worked down more or less, so as to suit the height, or the inclined position of the columns resting upon them, they of course become unequal in their thicknesses or heights, on account of the unequal heights of the columns, as well as on account of their inclined position, which consequently occasions the adjection to be higher under some columns than under others, and on one side than on the other. 2d, They appear as if channelled or grooved, because their measure is a little less than the square of the plinth of the base, in order to avoid rupturing the edges of the said plinth; wherefore there appears to be a groove or channel between the stylobatæ and the base of the column, which will seem to be wrought on purpose, provided the

Fig. XXVI. This done, the bases are fixed in their places, and are so proportioned, that, including their plinth, they have in height half the thickness of the column; and in projection, which the Greeks call *Ecpboran*, a quarter; so that their breadth and length will be once and an half the thickness of the column. Their height, if they are to be in the Attic mode, is so divided, that the upper part is one third of the thickness of the column, and the remainder is left for the plinth (r). The plinth being excluded, the remaining part is divided into four parts, and the upper torus (t) has one fourth; the remaining three parts are equally halved, and one half makes the lower torus (tt), and the other the scotia (s), which the Greeks call *Trochilon*, with its squares.

Fig. XXIV. But if the bases are to be made in the Ionic mode, they are so proportioned, that their measure on every side be equal to the thickness of the column, added to a quarter and an eighth of the said thickness. The height is the same as in those of the Attic kind; so also is the plinth. Excluding the plinth, the remainder, which will be equal to the third part of the thickness of the column, is divided into seven parts; of which three are for the torus (t) that is at the top; the remaining four parts are equally halved, and one part makes the upper trochilus (s), with its astragals and supercilium, and the other part is left for the lower trochilus (ss); but the lower one appears to be the largest, because it projects to the extremity of the plinth. The astragals are the eighth part of the trochilus. The projecture of the bases is an eighth, and a sixteenth part of the thickness of the columns.

line is made strait or level; for otherwise it would appear as a defect or accident. In this manner the adjections are found between the capital and architrave in the temple on the Ilissus at Athens are formed, as (i k, fig. XXII.); though in the Roman buildings, as in the portico of Octavia, the temple of Antonine and Faustina, the Thermæ of Dioclesian, &c. they are made larger than the incumbent epistylum. Lastly, concerning the correspondence these adjections have to the epistylum: As it has been made appear with the greatest probability, that the adjections must be a kind of flat horizontal bearers, which are covered by the immediately incumbent bases, it is evident, that the correspondence alluded to cannot consist in any apparent similarity of form between them and the members of the epistylum, as it has been generally supposed; the adjections can only be more or less high, and, of course, the incumbent parts more or less raised, so as to correspond to suit the level of the epistylum; and this, I imagine, is all the correspondence alluded to between the adjections in the stylobatæ and the members of the epistylum, that is meant by Vitruvius. But this will be farther discussed at Note 17.

I know not to what it may be imputable, that none of these adjections have been found, or at least noticed, under the bases of the columns in any of the antique edifices; they are found very frequently over the capitals. Indeed, the moldings of the bases are generally more mutilated and confused, which may prevent the observation of so small a member, and may make it appear of one piece with the decayed face of the plinth. They also may not have been used

under the bases in all buildings, as they were not in all buildings used over the capitals. In the Sybil's temple at Tivoli, there are such adjections to be seen under the torus of the bases, (for they have no plinth), which is the only instance I know of in which there is any appearance of them; and, in this temple, the columns have that inclination inward which Vitruvius directs. See note 17, ensuing.

(8*) Supercilium signifies in general any superior molding that crowns or terminates another member. In this case, it must mean some molding resting upon the scotia; but what particular molding cannot be ascertained.

(9*) Vitruvius says, the lower trochilus appears larger on account of its larger projection, or (in his own words) because it projects to the extremity of the plinth. This implies, that it is in fact no higher than the upper trochilus; and, if so, it must have its astragals and supercilium, as well as the upper trochilus. Also, as astragals are mentioned in the plural, it follows, that there must be two astragals to each trochilus. Again, as the trochilus must be terminated by some member both at top and bottom, and as the proportions of the astragals are mentioned, and no notice taken of the supercilium, it is probable that one astragal was at top, and the other at the bottom; and that the astragal at top is the molding here called the SUPERCILIUM; for, if the supercilium was any distinct molding, it is to be supposed that Vitruvius would have mentioned its proportion, as well as that of all the other moldings in the base.

THE bases being completed and fixed, the middle columns both of the pronaos and posticus are to be set perpendicularly on their axis; but those which are situated at the angles, and those on the flanks of the temple, to the right and left, have their inner faces, which are toward the walls of the cell, disposed perpendicularly, and their outer faces diminished as directed; for, by this means, the temple will have a just and proper diminution.^{10*}

Fig. XXIV. THE shafts of the columns being erected, the capitals, if they are to be of the pulvinated^{11*} kind, are to be made as follows: The Abacus is in length and breadth (a b) equal to the thickness of the bottom of the shaft, added to an eighteenth part thereof; and the height (d c), including the volutes, is the half. At the extremity (a) of the Abacus, an eighteenth part and a half (a d) is to be set back toward the inner part of the faces of the volutes; and from those four points, near the extremes of the Abacus, four lines (d c), which are called *Catheti*, are drawn downward. Then the thickness (d c) is divided into nine parts and a half, and of these nine parts and a half, one part and a half is left for the thickness (d f) of the Abacus, and the remaining eight are reserved for the Contour of the volute. After this, the lines (d c), which are drawn down, at the extremes of the abacus, and recede inwardly one part and a half, are so divided, that four parts and a half are left under the abacus; and at that point which separates four parts and a half from three parts and a half, the center of the eye (i) is marked, and round this center a circle is drawn, equal in diameter to one of the eight parts. This will be the size of the eye, and in this cathetus the corresponding diameters^{12*} are wrought. Then beginning at top, under the abacus, in the several operations of the quarters, the halved space of the eye is diminished, till it returns to the same quarter under the abacus.

Fig. XXIV. THE thickness of the capital is so divided, that, of nine parts and a half, three and XXV. fall below the astragal (F) at the top of the shaft. The parts above are left for the cymatium,^{13*} abacus (f), and channel (H). The projecture (n) of the cymatium, beyond

(10*) The text does not explain whether in these columns on the flanks the diminution on the outside is equal to the whole quantity of the diminution made on both sides of the other columns, or only the quantity made on one side; but most probably the whole quantity is meant: for otherwise these columns would be larger at the top than the others, which would cause a disproportion and dissimilarity in the capitals, and in the soffite of the epistylum. The columns of the Sybil's temple at Tivoli, are thus inclined, and have the whole diminution on the outer face.

The columns which are to be inclined are, I imagine, to be properly diminished, before they are erected; and the proper inclination is then given them, by disposing their axes out of the perpendicular so far, till the top of the shaft on the inner side becomes perpendicular with the bottom part.

(11*) Pulvinated, or bolstered, is a term applied to the Ionic capital, on account of its volutes resembling the ends of mattresses rolled up in the form of bolsters or cushions.

(12*) By *respondens diametros*, corresponding diameters, I suppose, we are to understand, corresponding centers; (i. e.) the centers which turn the several contours of the volute.

These central points are said to be in the cathetus of the eye: wherefore it should seem that the method of turning the volute here intimated, is like that given by Serlio, where all the central points are formed in the cathetal line, within the diameter of the eye. This method, however, gives an unhandsome oblique direction to the volute, and is not to be recommended.

(13*) The molding, here called the *cymatium*, is judged to be the echinus, or ovolo, (G, fig. XXIV. and XXV.

the square of the abacus, is equal to the size of the eye. The balthei^{14*} (e) of the bolsters have so much projecture from the abacus, that, when one foot of the compasses is placed in the quarter of the capital (m), and the other extended to the extremity of the cymatium (n), the circumferent line (n e) may touch the extreme parts of the balthei. The axes of the volutes (g) are no thicker than the size of the eye, and the volutes are so incased, that the depth is the twelfth part of their breadth. These are the proportions of capitals for columns not more than fifteen feet high; those which are higher have their symmetry accordingly^{15*}.

THE abacus will be in length and breadth equal to the thickness of the bottom of the column, and one ninth part^{16*}; so that, as the higher the column is, the less is its diminution,

(14*) The balthei, which signify bands or girdles, may probably be the moldings (e), which begirt the bolster or profile of the volutes.

(15*) The recess (a d) of the cathetal line from the extremity of the abacus, as described by Vitruvius, has been generally thought too much, being one part and a half of the eighteen parts, into which the bottom of the column is divided, causing the cymatium or ovolo to have a very large projection. Some therefore have supposed the text to have been corrupted: and Palladio Alberti, Vignola, and some others, have allowed it but one eighteenth part, intirely suppressing the half part. Scamozzi and Barbaro have given it one part and a quarter. The projection may be large, but it nevertheless seems to be such as was intended by Vitruvius; for it makes the projecture of the abacus no more than equal to its height, which is conformable to his general rule in all moldings.

As the draught of this capital, as well as the other figures, which Vitruvius annexed at the end of his book, are lost, it is not possible from this brief description to understand perfectly his method of forming the volute. What has been said above, at note 12, encourages an opinion, that it is something like Serlio's. On the other hand, his speaking of the operations of the several *quarters*, makes it supposable that it is one of those methods in which each point turns a quarter circle only; whereas, if all the points are in the cathetal line, as in Serlio's method they are, each point must turn a semicircle.

There are many different methods in use for turning the Ionic volute, which are described in the many books of architecture now extant, and to which therefore I refer the reader. Nicholas Goldmanno has published a tract concerning the Ionic volute of Vitruvius, where he supposes he has discovered Vitruvius's method. It is nearly like that method given by Mr. Riou in his Grecian orders, and said to be the same by which the volutes of the Ionic temple on the Ilissus at Athens were formed.

The method given by Galiani in his translation of Vitruvius, appears simple, easy, ingenious, and very con-

formable to the words of the text; but the centers are so disposed, that the contours of the several quarters do not coincide in a right line, but form angles where they meet each other.

I shall here describe a method of turning the Ionic volute, that has occurred to me, as it is easy to practise; and gives the volute a fine contour, very nearly agreeing with that of the theatre of Marcellus, according to Desgodetz, which has never yet been decyphered. The eye being drawn, according to Vitruvius's instructions, the cathetal line (o p, fig. XXV.) is put on the diagonal, (i. e.) on an angle of 45, the upper part leaning outward, and continued indefinitely; then, on this line, the eye is divided into four equal parts, 1, 2, 3, 4, which are the centers for turning the volute. The point 1, where the diagonal cathetus intersects the lower part of the circumference of the eye, turns from its perpendicular f, at the bottom of the abacus, till it meets the diagonal cathetus at o. The point 2, diametrically opposite, is the center that turns the semicircle o p; the point 1 again turns the next semicircle p q; 3 turns the next q r; 4 the next r s; 3 again turns the next s t; lastly, taking the middle 5 between t and 2, 5 becomes the last center, turning the semicircle t 2.

If the diagonal cathetus is turned on the other side, the perpendicular, that is, the under part, being directed outward, as from (u) to (u), the same process will describe an oval volute, having its longest diameter the contrary way.

(16*) The measure of the abacus was before said to be a diameter and an eighteenth, here it is said to be a diameter and a ninth; this the commentators account for, by supposing the former to relate to columns under fifteen feet, and the latter to all above that height; thereby supposing that the projection of the capital should be greater, in proportion as it is situated higher; which seems to me to be contrary to the intention of Vitruvius.

For Vitruvius speaks a little below of encreasing the proportional heights of members that are situated in high places; and for the same reason as the heights are encreased, the projectures in such situations should be diminished. He

for the same reason the capital is not without its due limitation of projecture, and its proportional addition of height. Concerning the description of the volute, the draught and method of properly turning it with the compasses is shewn at the end of the book.

THE capitals being finished, they are then fixed on the top of the shafts of the columns, not according to the level, but according to the equal modulary proportion; that an adjection like that made in the stylobatæ, may, in the upper parts, correspond to the symmetry of the epistylum.^{17*}

also fixes the projecture of the epistylum to be so much in all cases as shall make it perpendicular to the diameter of the column at bottom; by which it ever becomes proportionally less in projecture, as its situation is higher. See note 18.

This therefore directly opposes the opinion that the abacus should be proportionally larger, as the column is higher, and is a reason for believing it should be quite the contrary.

The commentators have been led into this opinion by the sentence following: *Uti quo minus habuerit altior columna contractum, eone minus habeat capitulum quæ symmetriæ projecturam, & in altitudine ratæ partis adjectionem*; they accepting *ne minus* for *more*; whereas it is, in my opinion, used only in the same sense as *nec minus*, or *non minus*, is frequently used in divers other places, *viz.* for *not less than the rest, neither, as well as, &c.*

As therefore it is doubtful which of these two dimensions is the right, and Vitruvius's rule for the proportion of the abacus of course remains uncertain, we must apply to the works of the ancients for information, and by their help form our opinion.

In the temple of Fortuna Virilis at Rome, the abacus of the column is a diameter and an eighteenth, its height from the ground is thirty-six feet French, and the proper height of the column is twenty-five feet.

In the theatre of Marcellus, the abacus is a diameter and a thirtieth, its height from the ground is fifty-four feet, and the column is twenty two feet high.

In these two examples therefore we find the abacus is proportionally less, as its real height is greater, agreeing with the implication of the context, and directly opposing the construction of the translators.

By this it appears, that the first mentioned proportion of the abacus, *viz.* a diameter and an eighteenth, is most probably the true one, and the latter the mistake; and also, that *ne minus habeat capitulum suæ symmetriæ projecturam*, must be understood to signify, that the proportional measure of the abacus must be diminished, not increased, in proportion as the columns are higher. And, lastly, if the latter measure, *viz.* a diameter and a ninth, should not be a mistake, it more likely is meant for the measure of the abacus of columns fifteen feet high and under, and the former measure for those which are above that height.

(17*) This is the passage before referred to, wherein the adjection in the stylobatæ is again mentioned.

In this place it is signified, that in fixing the capitals on the columns, the level is not regarded, but the equal modulum only; (that is, the equal and proportional heights of the columns, according to the number of modules assigned) to the end that the adjection mentioned may correspond to the epistylum. Hence the correspondence the adjection has with the epistylum must be of such a kind as suffices or answers for the want of levelness in the capitals; and the adjection must be something adapted to such a correspondence, for the epistylum must indispensably be supported level.

If then the tops of the capitals of the columns that support the epistylum, are, when fixed, not all on a level, some means must be found to make them so, or to answer the deficiency.

Vitruvius says the adjection is to answer this end; it must therefore be a kind of raiser or bearer of an unequal thickness, according as the tops of the capitals vary from the level, so as to cause the tops of the capitals to correspond with the level of the epistylum; which is, I imagine, all the correspondence of the adjection to the epistylum that is meant.

Thus far it favours the former opinion concerning the nature of this adjection or scamillus.

But this passage has, in my conception, a different signification to that given it by the commentators in general. They have interpreted it, so as to import, that the adjection in the stylobatæ has some correspondence with the epistylum, and the superior members. I understand, that the adjection in the stylobatæ is here spoken of only by way of comparison, and that it is another similar adjection (here directed to be made), which is said to correspond with the epistylum, or superior parts.

The reading is, *Uti quæ adjectio in stylobatis, facta fuerit in superioribus membris, respondeat symmetria epistylorum*, which is ambiguous, and will admit of both constructions; the reasons therefore which have governed my choice are those arising from the concurring circumstances of the context.

Vitruvius directs the columns on the flanks of the temple to have their axes inclined out of the perpendicular. The axes of the capitals and bases must undoubtedly coincide with those of the columns. The top surface, or bed of the

THE proportion of the epistylum (A D) is as follows : If the columns are from twelve to fifteen feet, the height of the epistylum is half the thickness of the bottom of the column. If from fifteen to twenty feet, the height of the column is divided into thirteen parts, and one part makes the height of the epistylum. If from twenty to twenty-five, the height is divided into twelve parts and a half, of which one part makes the height of the epistylum. If from twenty-five to thirty feet, it is divided into twelve parts, and one part makes the height. In this manner, according to the height of the columns, the height of the

capital, and that of the base, being at right angles with their axes, will therefore be out of the level. This circumstance makes it indispensably necessary to have some projection, bearer, &c. on the tops of the capitals, as well as under the bases of those columns, to rectify that obliquity, and present a level bed to the soffite of the epistylum. Likewise the unavoidable minute inequalities in the heights or levels of the perpendicular columns, as well as for other reasons before mentioned, make the same contrivance very proper, useful, and requisite in those columns also. Accordingly, we find the ancients generally used such adjunctions or bearers on the tops of the capitals, as the remains of their works sufficiently evince, in the manner (i k), fig. XXII.

Adjunctions on the capitals being then so necessary, convenient, and generally used by the ancients, it is scarcely to be supposed that Vitruvius would omit to speak of them, especially, as he has before spoken of a similar minutia in the stylobatæ.

It has been before noticed, that Vitruvius treats of each part of the fabric according to the order of its height, beginning from the foundation, and so proceeding upward. He spoke of the adjunction in the stylobatæ, between the stylobatæ and the base : here he speaks of an adjunction again, between the capital and the epistylum, which is the proper place of the adjunction on the capital, and in which place they are found in the ancient remains.

Hence it is highly probable, that this latter adjunction, which he here mentions, is that between the capital and epistylum, and not the same adjunction that was before mentioned in the stylobatæ. But the next argument may be more convincing, if not decisive.

It is said, in fixing the capitals, the level is not regarded, to the end that the adjunction (which ever it is) may, in the upper parts correspond to the epistylum.

The nature of the correspondence between the adjunction and the epistylum has been before demonstrated. The adjunction in the stylobatæ cannot have such correspondence ; for, however it may be formed, it cannot raise the declined bed of the capitals of the inclined columns to a level, without reversing the inclined position of the columns, and causing them to lean outward instead of inward. This will be readily perceived upon a little reflection.

It cannot be supposed that the nature of the correspondence between the adjunction and the epistylum consists in a similarity in figure or measure, as has been heretofore sup-

posed by former translators ; for the words, *The capitals are not fixed level, to the end that the adjunction may correspond to the epistylum*, imply a mutual relation and dependence between the manner of fixing the capitals, and the correspondence of the adjunction to the epistylum ; but a correspondence of figure, &c. between the adjunction and epistylum can have no relation or connexion to any manner of fixing the capitals on the columns, so that the reasoning would be totally incoherent ; and it might as rationally be said, the capitals must be fixed level, to the end that the foundation may be well built.

Hence the adjunction alluded to cannot be that in the stylobatæ ; it follows that it must be some other, and the order of mentioning it, as well as the use ascribed to it, (which no other would answer), prove it to be that adjunction generally used by the ancients on the tops of the capitals.

Thus considering it, we shall find all circumstances agree ; for there is certainly a mutual relation and dependence between the manner of fixing the capitals, and the correspondence of such adjunction to the epistylum ; for this adjunction is the medium that reconciles the different levels of the beds of the capitals and the bed of the epistylum ; and thus the reasoning of the text becomes coherent and just ; and the words *superioribus membris* become pertinent, which otherwise seem superfluous and unnecessary.

Galiani confesses not to understand this passage, nor what can be meant by Vitruvius's injunction not to observe the level, but the *equalem modulum* only, in fixing the capitals.

The foregoing sufficiently explains the meaning of that injunction ; viz. that the capitals are to be so fixed on the columns, as to preserve the due height of the columns, according to the number of modules assigned equal in all, preserving the coincidence of their axes, &c. without regarding the level of the epistylum, or that of their own bed, which deficiency is to be rectified by the adjunction or scamillus mentioned.

If then the above arguments are allowed to be just, and it is sufficiently clear that the adjunctions here alluded to are those generally used by the ancients on the tops of the capitals, whose nature and form are well known ; it follows that those in the stylobatæ are of the same kind, (for Vitruvius compares them together) : and thus the long contested argument concerning the use, form, and precise situation of the scamilli impares will be determined.

epistyliums is proportionally determined; for, when the sight is directed upward, it does not so easily penetrate the density of the air, but glances over the altitudinal spaces, and its strength being impaired, it makes an uncertain judgment of the dimensions. Wherefore a proportional addition is ever to be made to the members, when the building is situated high, or is of a Colossal magnitude. The breadth of the epistylum at the bottom part, which rests upon the capital, is made equal to the thickness of the top of the column, just under the capital; and the top (of the epistylum) is equal to the bottom of the (shaft of the column.)^{18*} The cymatium (D) is the seventh part of the height of the epistylum, and in projecture it is the same. The remainder, exclusive of the cymatium, is divided into twelve parts; and of these, the first fascia (A) has three, the second (B) four, and the uppermost (C) five. The zophorus (op)^{19*} is a fourth part less than the epistylum which it rests on; but

(18*) Galiani, as well as Perault, observes, that, by this rule, in very high columns, the diminution being very small, the projection of the epistylum (or architrave) would of course be too little, and therefore they suppose, that by the top of the epistylum should be understood the top of its upper fascia, excluding the cymatium. But, supposing this should be the case, it still conforms to the same principle of making the projectures less as the heights are greater, and only transfers the rule from the top of the cymatium to the top of the upper fascia. If this principle therefore is allowed in one part, it must be in another; and if it is practised in the fascias, it should be in the cymatium also. This, however, will not be the case in the cymatium, if we suppose it not to be included in the projecture here allowed to the epistylum; for, as the higher the columns are, the higher is the epistylum, and as the cymatium has in height and projecture the seventh part of the height of the epistylum, consequently the projecture of the cymatium will be greater the higher the columns are, at the same time that the projecture of the fascias will be less. This is so inconsistent, that I cannot help believing that Vitruvius certainly includes the cymatium in the projecture he allows to the epistylum, the rather, because it is evident, that he includes the cymatium by the word epistylum, where he mentions its height, (for he speaks just below of the remainder of the height of the epistylum, when the height of the cymatium is taken from it): and therefore there can be no doubt but that he includes the cymatium by the word epistylum, where he speaks of its breadth; consequently the top of the epistylum must mean the top of the cymatium of the epistylum. This argument is also strengthened by the example of the temple of Fortuna Virilis at Rome; the projection of the cymatium conforms to the rule here given, the extremity of the cymatium being perpendicular to the bottom of the shaft of the column.

Nor can I think this a bad rule, or foreign to the intention of Vitruvius: for he says, altitudinal spaces are diminished in appearance at great heights, and therefore they should be proportionally increased; and for this very reason projectures in such situations should be proportionally

lessened, that they may not contribute to make the altitudinal spaces appear less; for a small projecture at a great height, or a near view, obstructs the sight of a great altitudinal space above it; and therefore the projecture of the epistylum on very high columns ought to be small, in order to hide as little as possible of the incumbent frieze.

These arguments also help to confirm the opinion concerning the projecture of the abacus, mentioned at note 16, foregoing, and to prove that Vitruvius does not here mean that its projecture should be proportionally larger in higher columns, as all the translators have rendered it, but the contrary; for the projecture of the abacus has the same influence on the members above it, as that of the epistylum has, and it is therefore most likely that Vitruvius would advise the same method to be observed in both cases, not the direct contrary.

I am therefore of opinion that Vitruvius intends the height only of the epistylum to be altered by the variation of the height of the columns, and that all its projectures are to remain the same in all cases, (*i. e.*) its top is to be always perpendicular with the bottom of the column.

I have given draughts of the epistylum according to the lowest and highest proportion here mentioned. The former agrees with that of Fortuna Virilis; the latter is not quite so high as that of the theatre of Marcellus, which is three quarters of a diameter, whereas this amounts only to two thirds of a diameter and the twenty-fourth part; I have drawn it only two thirds, as being a proportion more consistent to the other members. See Fig. XXIV. No. 3, 4, and 5.

(19*) The zophorus is that member which we call the *frieze*, op, fig. XXIV. Vitruvius does not inform us whether or not the cymatium of the zophorus is included in the measure he allows to its height. I have represented it not included; and, with the proportionally lowest epistylum, I have joined the proportionally highest zophorus that Vitruvius describes, and, with the highest epistylum the lowest zophorus; by which means the epistylum and zophorus together rise to the same height in both cases; but the cornice of the latter

If it is intended to be ornamented, it should be a fourth part higher than the epistylum, that the sculpture may be conspicuous; its cymatium (E) is the seventh part of its height; the projecture of the cymatium is equal to its thickness.

UPON the zophorus the denticulus (v), is formed equal in height to the middle fascia of the epistylum, and its projecture is the same as its height. The intersection, which by the Greeks is called *metoche*, is so ordered, that the dentil has in front the half part of its height, and the void of the intersection is two thirds of the breadth of the front; its cymatium is the sixth part of its height. The corona (q), with its cymatium, exclusive of the *fima* (x), is equal in height to the middle fascia of the epistylum. The projecture of the corona, together with the dentil, is made equal to the height from the zophorus to the top of the cymatium of the corona; and all moldings in general will have the best effect when their projectures are made equal to their heights.

THE height of the tympanum (E) of the fastigium is thus determined: The whole front of the corona, from the extremes of the cymatium, being divided into nine parts, one of those parts makes the height of the middle point of the tympanum. Its surface is perpendicular with the lower fascia of the epistylum, and with the hypotrachelium of the columns. The coronæ, which lye upon the tympanum, are, excepting the *fimæ*, disposed like those below. Over the coronæ are the *fimæ* (x), which the Greeks call *epitithedas*; they are made an eighth part higher than the coronæ.

becomes larger, on account of its being governed by the height of the epistylum. Likewise, in the former case, for the sake of proportion and conformity to the antique, and also as the difference is very small, I have drawn the zophorus higher than the epistylum a fourth part of itself, instead of a fourth part of the epistylum; so that, in one case, the epistylum has three and the zophorus four parts; and in the other, the epistylum has four, and the zophorus three parts, each part being one sixth of a diameter. I have however made no variation in the reading from the words of the text.

But if, with the highest epistylum, (I mean such as is directed for columns of thirty feet high) a frieze of the highest proportion prescribed is adjoined, (*i. e.* one that is a fourth part higher than the epistylum) then the whole entablature becomes larger than in either of the former cases, exceeding two diameters in height, as the draughts demonstrate. So that Vitruvius is misrepresented by those masters, who give the proportions he allows to the smallest columns, as those which are to be invariably applied to columns of all magnitudes, and in all situations, from which misrepresent-

ation Vitruvius has been unjustly accused of littleness, and of not allowing a sufficient magnitude to the entablature of this order.

(20*) This must be understood, from the top of the cymatium of the zophorus, to the end that it may conform to the rule immediately after given, *viz.* of making the projectures equal to the heights.

(21*) The word coronæ is sometimes used for the whole cornice, and sometimes for that single member generally called *corona* (q Fig. XXIV.) in which latter sense I think it must be here understood; for it was the practice of the Greeks to have no other member than the corona and *fima* to run up the declivity of the tympan: and it is agreeable to the principle Vitruvius mentions in the second chapter of the fourth book. It being also said, that *the fima is to be an eighth part higher than the corona*, confirms the opinion; for it cannot be supposed that Vitruvius means the *fima* to be an eighth part higher than the whole cornice, that being too extravagant to be admitted.

Fig. XVIII. THE acroter^{22*}ia (a c) at the angles are as high as the middle of the tympanum; and the middle one (b) is an eighth part higher than those at the angles.

ALL the members which are above the capitals of the columns, *viz.* the epistylum, zophorus, coronæ, tympanum, fastigium, and acroter^{22*}ia, are to incline forward in the front the twelfth part of their height; for, when we stand opposite to the front, two rays diverging from the eye, one to the bottom of the work, the other to the top, that which ascends to the top will be the longest; the visual lines, therefore, that extend to the upper members being the longest, make the faces of those members appear to lean backward; so that, when they are inclined forward, as above written, they then seem to be perpendicular and upright.^{23*}

Fig. XXIV. THE strig^{24*}æ (L) of the columns are in number twenty-four, and are so excavated, that a square being applied to the hollow of the strigæ, and turned round, the arms of the square may touch the edges of the striæ to the right and left, while the point passes round, and touches every part of the circumference.^{25*} The thickness of the striæ is made equal to the swell in the middle of the column, which may be found by the description.^{26*}

THE simæ, which are upon the flanks of the temple, are to have the sculptures of lions heads; and first, those which are perpendicular to the several columns are to be designed,

(22*) The acroter^{22*}ia are the little pedestals placed on the pediment, or fastigium, to bear the statues. I agree with Galiani, that the word *medium*, in the text, must be understood to refer to the middle of the height of the tympanum, not to the middle of its length; for, in the latter case, the acroters would be uselessly and preposterously high. I also judge they are meant to be on a level with the said middle of the tympanum, and not to be as high as half the height of the tympanum in their own proper measure. See c in the elevations of Fig. XIV. to XXI.

Where the elevation is broad, and the tympan of course high, the height of the acroters, according to this rule, becomes apparently too great, as may be seen by the acroters (c) in the several elevations above mentioned; and as, by this means, their proportional magnitude encreases as the breadth of the front encreases, (which is unnecessary, considering their use), the rule seems not to be eligible, without some limits be fixed where the proportion should vary.

I submit it to the public judgment whether it might not be a good rule, to make the acroters at the angles so high above the top of the cornice as is equal to the projection of the cornice, whatever it may be; for, by this rule, their height will always be sufficient to prevent their being hid by the projection of the cornice, if viewed at a moderate distance; and never too much, whatever may be the breadth of the front of the temple. I however would exclude the Tulcan cornice, on account of its enormous projection.

(23*) In the theatre of Marcellus at Rome, the fascias of the epistylum are inclined forward in the manner here directed. In cases where the members are thus inclined, the projectures must ever remain the same, as if the members were perpendicular. This must undoubtedly be understood; for otherwise, the quantity of inclination in some parts being greater than the quantity of projecture, (as in the fascias of the epistylum), the incumbent members in such parts would appear to recede, instead of projecting.

(24*) Vitruvius uses indifferently the words strigæ and striæ, to signify the flutings or channellings of the columns. Some suppose he uses striæ for the fillets or squares between the channels, as in this place he seems to do; but at the third chapter of the fourth book, he evidently applies the word striæ to the channels only; for, at that place he is speaking of the Doric channels, which have no fillets between them.

(25*) This is as much as to say, the channels are to be made semicircular; for the elbow of a square revolving between two points, the two arms continuing all the while to touch both the said points, describes a semicircle.

(26*) The thickness of the fillets are about the thirtieth part of the diameter of the column. See note 11, at the second chapter of this book.

the rest are disposed equidistantly, in such a manner, that each may answer to the middle of each respective ^{27*}tile. Those which are over the columns are to be perforated, for a channel to convey the rain-water from the tiles; but those which are between are imperforate, that the water may be discharged from the tiles by the proper channels, and not fall in the intercolumns, nor overflow the passengers: so that the lions heads, which are over the columns, seem to disgorge the water from their mouths. Thus I have, in this book, described, as well as I have been able, the construction of Ionic temples. The proportions of the Doric and Corinthian kind I shall explain in the following book.

(27*) Perault thinks this should not be understood each tile, but *each water channel*, made in the roof; and Galiani thinks it should be read *the middle channel*: but the text clearly enough expresses each tile, and I cannot see any absurdity in supposing the ancient tiles were so large as to be equal to the distances between the lions heads; for in some parts of Italy, at this day, tiles of such a magnitude are used as is equal to the distances that may be supposed to have been between the lions heads; and in the Tower of the Winds at Athens, this rule is fully exemplified, the middle of the tiles coinciding exactly with the middle of the lions heads in the sima.

The breadth of the lower range of tiles in this tower is two feet eleven inches, though the distance from center to

center of the heads is three feet ten inches, owing to the divergence of the radial lines. Supposing, however, two feet eleven inches, or even two feet six inches, or less, to have been the size of the ancient tiles, and consequently the distances of the lions heads from each other, this measure will be sufficiently large to admit us to suppose, that a head might have been placed opposite to each tile; for, allowing only the number of two heads to happen in the intercolumns, (and less cannot be allowed, for Vitruvius speaks of them in the plural) the centers of the columns may be seven, eight, or nine feet apart; which is a sufficient and ample distance for moderately large temples of the pycnostyle or systyle kinds.

THE END OF THE THIRD BOOK.

T H E
A R C H I T E C T U R E
O F
M · VITRUVIUS · POLLIO.
B O O K T H E F O U R T H.

P R O E M.

AS I have observed, O Emperor! many treatises of architecture, and books of commentaries, undertaken without method, and executed in such a manner, as to omit various articles, I judged it proper and useful to reduce the substance of this work to a regular order, and, in the several books, to explain the nature of the several things herein written. I have therefore, O Cæsar! in the first book, explained to thee the qualifications of an architect, and the knowledge he should possess. In the second, I have discoursed on the materials of which buildings are constructed. And, in the third, of the composition of sacred edifices, of their various kinds and species, and of their distribution according to their several kinds. Of the three orders which have precise modular proportions, the Ionic I have already taught; in this book, therefore, I shall speak of the Doric and Corinthian, and of their differences and properties.

C H A P T E R I.

Of the three Kinds of Columns, and of their Invention.

Fig. XXIII. CORINTHIAN columns, excepting in their capitals, have their symmetry the same as the Ionic; but the height of the capital renders them proportionally taller and more graceful; for the height of the Ionic capital is only a third part of the thickness of the column; whereas that of the Corinthian is the whole thickness of the shaft: wherefore, as two thirds of the thickness of the column are added to the capitals of Corinthian columns, it causes them to appear higher and more graceful. The other members which are placed above the columns, are taken from the Doric or Ionic orders, and disposed over Corinthian columns: for the Corinthian has no cornice, or other ornaments peculiar to itself, but has either triglyphs, mutules in the cornice, and guttæ in the epistylum, as in the Doric manner; or else, according to the Ionic manner, the zophorus is ornamented, and dentils are disposed in the cornice.^{2*} So that by these two orders, joined with a different capital, a third order is produced; for, from the formation of the three kinds of columns, arise the denominations, Doric, Ionic, and Corinthian; of which the most ancient and first invented is the Doric; for, when Dorus, the son of Hellenus and the nymph Opticos, reigned over all Achaia and Peloponnesus, the temple of Juno, in the ancient city of Argos, was erected, and this order happened to be used in the same. The same order was also used in the other cities of Achaia, before the laws of its symmetry were established.

AFTERWARD, when the Athenians, according to the responses of Apollo of Delphos, and the common consent of all Greece, transplanted, at one time, thirteen colonies into Asia, appointing to every colony a leader, they gave the chief command to Ion, the son of Xuthus and Creusa, whom also the Delphian Apollo acknowledged for his son. These colonies he conducted to Asia, seized on the territory of Caria, and there founded many large cities, as, Ephesus, Miletus, Myunta, (which last was formerly overflowed with water, and its rites and privileges, by Ion, transferred to the Milesians) Priene, Samos, Teos, Colophon, Chios, Erythræ, Phocis, Clazomenæ, Lebedus, and Melite. This latter, on account of the arrogance

(1*) Reckoning from the top of the abacus to the bottom of the echinus, not to the bottom of the volute. Vitruvius therefore allows the Corinthian shaft to be of the same height as the Ionic shaft, and the whole column, including base and capital, two thirds of a diame-

ter higher than the Ionic; that is, nine diameters and a sixth.

(2*) This accounts for the differences found in the antique examples of the Corinthian order, which the ancients deemed a compound order.

of the citizens, was destroyed in the war declared against it, by the unanimous determination of the other cities, and, in its place, by the favour of King Attalus and Arfinoe, the city of Smyrna was received amongst the Ionians. When these cities extirpated the Carians and Leleges, they, from their leader Ion, called that territory *Ionia*.

THERE they began to erect fanes, and constitute temples to the immortal Gods. First, they erected the temple of Apollo Panionios, in the manner they had seen it in Achaia; which manner they called *Doric*, because they had seen it first used in the Dorian cities. In this temple they were desirous of using columns; but being ignorant of their symmetry, and of the proportions necessary to enable them to sustain the weight, and give them an handsome appearance, they measured the human foot, and finding the foot of a man to be the sixth part of his height, they gave that proportion to their columns, making the thickness of the shaft at the base equal to the sixth part of the height, including the capital. Thus the Doric column, having the proportion, firmness, and beauty of the human body, first began to be used in buildings.

AFTERWARD, to construct the temple of Diana, they sought a new order from the same traces, copying the gracefulness of women, and making the thickness of the columns an eighth part of their height, in order to give them a taller appearance. The folds of the base they designed for the shoe; the volutes of the capital for the tresses of hair, dropping to the right and left; the cymatium and encarpi^{3*}, for the locks disposed to ornament the forehead; and the channels of the shaft for the plaits of the matrons garments. Thus arose the invention of these two different orders; one of a masculine appearance, naked and unadorned; the other imitating the slenderness and fine proportion of women. But posterity, improving in ingenuity and judgment, and delighting in more graceful proportions, fixed the height of Doric columns at seven times their diameter; and of the Ionic, at eight and a half. This latter order was called Ionic, because it was first used by Ion.

THE third, which is called *Corinthian*, is in imitation of the delicacy of virgins; for, in that tender age, the limbs are formed more slender, and are more graceful in attire. The capital is reported to have been thus invented: A Corinthian maid, just marriageable, being seized with a disorder, died: after her interment, her nurse collected, and disposed in a basket, the toys which pleased her when alive, carried it to the tomb, placed it on the top, and, that it might endure the longer in the open air, covered it with a tile. The basket chanced to be placed over the root of an acanthus, which, being thus depressed in the middle, the leaves and stalks, in the spring season, issued outward, and grew round the sides

(3*) Encarpi alludes to some ornaments in the Ionic capital; but which it precisely means is doubtful; some take it for the festoons hanging from the eyes of the volutes; others for the pods, which spring from the volutes, and cover

the angles between them and the ovolo; and others again for the foliage in the channel under the abacus. It may also mean the carving of the abacus, or flower in the middle of the same, as most resembling the locks on the forehead.

of the basket; and, being pressed by the weight at the angles of the tyle, were made to convolve at the extremities, like volutes. At that time Callimachus, who, for his ingenuity and excellence in the arts, was, by the Athenians, named *Catatechnos*^{4*}, happening to pass by this tomb, took notice of the basket, and being pleased with the delicacy of the foliage growing around it, as well as the novelty of the form, made some columns near Corinth, according to this model, and from thence established the symmetry, and determined the proportions of the Corinthian order.

Fig. XXIII. THE symmetry of this capital is thus performed. The height of the capital (a c), including the abacus, is to be equal to the thickness of the column at bottom. The breadth of the abacus is so regulated, that its diagonal, from angle to angle (d d), may be twice as much as the height of the capital; for this gives a proper dimension to each face. The fronts of the abacus are bowed inwardly (g i), from the extreme angles (d f), a ninth part of its breadth^{5*}. The bottom of the capital is as thick as the top of the column (h), without the apothesis^{6*} (n) and astragal (o). The thickness (a m) of the abacus is the seventh part of the height of the capital. The remainder, when the thickness of the abacus is deducted, is divided into three parts, of which one is given to the lower leaves; the second is for the height of the middle leaves, and to the caulicules or stalks, from which leaves project, so as to support the abacus, the same height is given. From these caulicules the volutes spring, projecting to the extreme angles; and the lesser helices (k) are wrought under the flowers, which are in the middle of the fronts of the abacus. The flowers on the four sides, are, in size, equal to the thickness of the abacus. Thus the Corinthian capital will have its proper symmetry.

THERE are also other kinds of capitals, called by various names, which are disposed on the same columns, and which have no proper symmetry, or relation to any order of columns that can be named differently; but they are all derived and transferred from the Corinthian, pulvinated, or Doric orders, from whose symmetries they differ only in the little novelties of the sculpture.

(4*) Catatechnos, the first of artists.

(5*) Vitruvius says nothing of obtunding or cutting off the corners of the abacus, as generally practised by the ancients as well as moderns: from whence we are led to believe, that the sides of the abacus of the Corinthian capital, according to Vitruvius, should terminate in four acute

angles, as (d d) Fig. XXIII. Of this kind are the capitals of the Temple of Vesta, at Rome, and those of the Poikile, or Stoa, at Athens.

(6*) Apothesis is the small square, or fillet, under the astragal at the top of the column; at the seventh chapter of this book it is called apophygis.

C H A P T E R II.

Of the Ornaments of Columns.

AS the origin and invention of the several orders of columns are above described, it seems to me not improper to speak also of the origin of their ornaments,* and of the principles from which they were derived.

Fig. XXVIII. IN the upper part of all edifices, timbers, called by various names, are disposed, which, as in names, so in uses, differ. The trabs (e) are those laid over the columns, parastatæ, and antæ, in the contignations and floors. If the span of the roof is great, under the culmen (m), in the top of the fastigium, are disposed columens (a), from whence columns derive their name, transtræ (b), and capreols (d); but if the span is small, columens and canthers (c), projecting to the extremities of the eaves. Above the canthers are the templats (f); and over them, but under the tyles, are the assers (g), projecting so far as to shelter the walls. Thus each, according to its use, has its proper place and order.

(o*) By the word ornaments is to be understood entablatures, Vitruvius expressing them by that appellation.

(1*) I have adhered to the Latin names of the timbers, in order to preserve a similarity between the reading of the text and of the translation, and to give the reader a better opportunity of making his own judgment of the timbers meant by those names, mentioning my own opinion thereon in the notes.

The traves, or beams, are undoubtedly the plates, or raising plates, as our workmen call them; being the timbers that are laid upon the summit of the walls, columns, &c. receiving the pressure of the roof, and distributing it equally over the supports. From this timber, the architrave, or epistylum, is derived, e e Fig. XXVIII.

The column, or columen, I conceive to be that upright piece (a a), by us called king-post, which is situated perpendicularly under the ridge of the roof, descending from thence to the tigna h, or cross beam, below. Some have taken it for the horizontal piece in the ridge, called the ridge piece, (m m) and which, Vitruvius, in this place, as well as in the first chapter of the fifth book, calls culmen.

The name of columen, being derived therefrom, is a circumstance that favours the supposition of its being a perpendicular piece; and the king-post, which is a principal and necessary part of a large roof, and the mention of which is to be expected, in a description of the timbers of a roof, is no where else mentioned.

The transtræ I was about to accept, as others have done, for the horizontal beams, h h that lay cross the building, holding together the opposite walls, when I observed that those cross beams are mentioned in the next paragraph by the general name of tigna: and it is said that the transtræ

are used in large roofs only, not in small. Also in the description of the Basilica of Fano (Chap. I. Book V.) Vitruvius mentions transtræ supporting the culmen, where it is evident no such horizontal beams can be used, on account of the vault of the ceiling rising into the angle of the roof; and where those who have supposed the transtræ to be the horizontal beams have represented no such beams; and consequently no transtræ, although Vitruvius expressly mentions them. From these circumstances, I judge the transtræ to be the principal rafters (b b); for those rafters, and the braces, or capreols (d) as well as the king-post (a) are (as Vitruvius says) used only in large roofs, not in small; and are necessary, not only on account of the magnitude of the roof, but on account of the projecture of the small rafters beyond the ends of the tigna (in the same manner as the mutules project beyond the triglyphs;) and which could not happen without the assistance of such principal rafters to support them. I do not suppose these transtræ, or principal rafters, to have been used at every tigna, but at proper distances.

The capreols are universally allowed to be the struts, or braces (d d.)

The canthers are evidently the common rafters (c c); for Vitruvius says, the declination of the mutules are in imitation of the inclined position of the canthers. I have purposely avoided drawing the canthers so broad in proportion as the mutules are generally represented.

The templats are the cross pieces (f f) serving to support the assers in the spaces between the canthers.

The assers seem to be small pieces ranged very close, in order to support the tiles; for Vitruvius says, they laid between the templats and the tiles; and the dentils are in imitation thereof.

THIS disposition of the work, the artificers, when they erected sacred edifices, imitated in sculptures of stone and marble; and this invention the ancient workmen thought proper to pursue. Thus, whenever they constructed any building, they laid the joists from the interior walls to the extreme parts, then built up the interjoist (k), and, to give the work a pleasing appearance, adorned the top with a cornice and fastigium; then, as much of the joists as projected beyond the wall they sawed off; which appearing unhandsome, they made tablets (h), like the triglyphs now in use, fixed them against the sawed ends of the joists, and painted them in wax, that the sectures of the joists might not offend the sight. Thus the triglyphs, interjoists, and opæ,^{2*} in Doric work, had their origin from the disposition of the timbers of the roof.

AFTERWARD, in other works, some made the canthers, that were perpendicularly over the triglyphs, to project outward, and carved their projecture; hence, as the triglyphs arose from the disposition of the joists, so the mutules under the corona were derived from the projecture of the canthers: wherefore, in stone or marble structures, the mutules are represented declining, in imitation of the canthers; and also, on account of the droppings from the eaves, it is proper they should have such declination.

FROM this imitation, therefore, arose the use of triglyphs and mutules in Doric work: for it cannot be, as some erroneously assert, that the triglyphs represent windows; because triglyphs are disposed in the angles^{3*}, and over the quarters^{4*} of the columns, in which places windows are not permitted; for if windows were there left, the union of the angles of buildings would be dissolved; also, if the triglyphs are supposed to be situated in the place of the windows, by the same reason, the dentils in Ionic work may be thought to occupy the places of the windows; for the intervals between the dentils, as well as between the triglyphs, are called *metopæ*; the Greeks calling the bed of the joists and assers, *opas*, (as we call it *cava*, *columbaria*); so because the interjoist is between two opæ, it is by them called *met-opæ*. As the triglyphs and mutules in the Doric order are founded upon these principles, so the dentils, in the Ionic, derive their proper origin from the workmanship; and as the mutules represent the projectures of the canthers, the dentils in the Ionic order are in imitation of the projecture of the assers. For this reason, in Grecian buildings, dentils are never placed under the mutules; for assers cannot be under canthers. As therefore they should in reality be above the canthers and templat, if they are represented below them, the work is on false principles. The ancients likewise did not approve of placing mutules or dentils in the fastigium, but the

(2*) Opæ is explained farther on in this chapter.

(3*) In the ruins of the Grecian buildings at Athens, and also in some at Paestum, in Italy, we find the triglyphs placed close to the angles, not perpendicularly over the middle of the columns, as practised in the Roman as well as modern architecture.

(4*) By this expression we are to understand the middle of the columns, for the quarters of the columns, I suppose,

mean the four parts of the column, when divided on the plan, by two diagonal lines passing through the center at right angles to each other, in the form of a cross, thus,



In the next chapter Vitruvius calls them the middle quarters, which are the two quarters a and d in the middle of the front and rear of a column so divided, having the two other quarters b and c on either side them.

corona only; because, neither canthars nor assers are laid toward the front of the fastigium, nor can they there project, for they are laid inclining toward the eaves. As, therefore, it could not be done in reality; they judged it not proper to be done in representation; for the propriety of all things, which they introduced in works of perfection, they derived from truth and nature; and approved those only which could bear the test of rational argumentation. From these principles they established the symmetry and proportions of each order; of which, pursuing the description, and having spoken above of the institution of the Ionic and the Corinthian, I shall now briefly explain the proportion and formation of the Doric.

C H A P T E R III.

Of the Doric Order.

SOME architects have maintained, that temples should not be built of the Doric order, because it occasions an imperfection and an inconvenience in the symmetry; for this reason it was rejected by Tarchesius, Pytheus, and also by Hermogenes: the latter, after he had prepared marble materials for a Doric temple, altered them, and from the same materials raised an Ionic temple to Bacchus. However, it was not because the appearance was unhandsome, or the manner or form ignoble; but because it impeded the distribution, and the arrangement of the triglyphs and lacunars^{1*} was unsuitable to the design; for it is necessary that the triglyphs should be disposed over the middle quarters of the columns; the metops, which are between the triglyphs, be made as long as high; and the triglyphs over the angle columns be placed at the extremities, and not over the middle quarters. So that the metops which adjoin the angular triglyphs, are not square, but more oblong by half the breadth of a triglyph^{2*}. Those who would make all the metops equal, contract the extreme intercolumn

(1*) The lacunars are the coffers or pannels usually formed in the soffites of the corona, or architrave, as well as in the ceilings, &c.

(2*) Galiani, as well as Perault, remarks, that the metop is not encreased quite half the breadth of a triglyph, but less than half, by as much as the semi diminution of the column. This is not the fact; they have not recollected the lateral projection of the triglyph from the face of the frise, but have supposed the outer edge of the angular triglyph to be perpendicular with the top of the shaft of the column; whereas, according to the rule of Vitruvius here given, the said outer edge will ever be perpendicular to the bottom of the shaft, which was the constant practice of the Greeks; so that the extreme metop was encreased half the breadth of a triglyph

exactly, and the projection of the triglyphs was the only thing varied by the various diminution of the columns.

The projection of the triglyphs will by this rule be less, in proportion as the column is taller, and less diminished; which is agreeable to the remark made at the third chapter of the third book.

The method of placing the outer edge of the angular triglyphs perpendicular to the bottom of the shaft of the column, was generally practised by the Greeks, as is proved by all the examples of Grecian temples now remaining; but they made the face of the epistylium also in the same perpendicular; whereas Vitruvius directs this latter to be perpendicular to the top of the shaft, and, (as may be inferred from the context) the face of the frise or metop also. See note 4th ensuing.

half the breadth of a triglyph; but this, whether it is done by lengthening the metop, or by contracting the intercolumn, is a defect. On this account, the ancients avoided the use of the Doric order in sacred edifices. Following however our method, we shall give the explanation of this order, as we have received it from the masters; so that those who attend to these precepts will here find described the rules by which they may erect a temple in the Doric manner, without fault or imperfection.

Fig. XIV. and XV. THE front of the Doric temple, where the columns are erected, is, if tetrastyle, divided into XXVIII parts; if hexastyle into XLIV^{3*}. Of these parts one will be a module, called in Greek *embates*, by which the distribution of the whole work

(3*) The numbers 28 and 44, which are found in the manuscripts, have been altered by all the translators to 27 and 42; they supposing the former two numbers to have been erroneous, and to have arisen from the mistake of the copyists; because, upon computing the number and measure of triglyphs and metops afterward described in the front, the latter numbers are produced.

Their manner of computation is as follows: In the tetrastyle temple is 11 triglyphs, at one module each, and 10 metops at a module and a half each; which together make 26 modules; and that, added to half a module at either end, amounts in all to 27 modules.

In the hexastyle temple is 17 triglyphs and 16 metops; which, according to the measures abovementioned, make 41 modules, and 1 module being added for the semi-metops at the angles, it amounts in the whole to 42 modules.

But, upon reflecting on the facility of the computation, the general agreement of the copies, and the improbability of so evident an error being generally and uniformly continued, I was induced to suspect, that the source of this disagreement lay in some other tract.

Pursuing this thought, and observing that Vitruvius (a little farther) says, this disposition is for diastyle work, I tried the computation according to that species of intercolumniation, and found it exactly agreed therewith; the numbers, as generally wrote in the text, happening right in both instances. Thus, in the tetrastyle temple, the two lateral intercolumns, at 3 diameters, or 6 modules each, is 12 modules; the middle intercolumn to contain three triglyphs must be 8 modules; and the four columns, at 2 modules each, is 8 modules; which altogether make 28 modules, the number of the text. So, in the hexastyle temple, the four lateral intercolumns, at 6 modules each, is 24 modules; the middle one 8, and the six columns 12; which in all make 44 modules, as in the text. But, in this case it will happen that the metops in the lateral intercolumns will be a sixth part of a module longer than a module and a half, the measure generally allowed them; and, on the other hand, if the metops are computed no more

than a module and an half, the lateral intercolumns will be half a module less than three diameters, the just measure of diastyle work. It may be said, that the deduction of half a module does not change the species of intercolumniation; but I answer half a module changes eustyle to systyle; and, if a small difference from the prescribed measure may be allowed in the intercolumns, it may also, with as little impropriety, be allowed in the metops.

The differences in the proportion of the metops that may be observed in the several Grecian ruins, in those at Paestum, and in other remains of antiquity, make it appear, that the ancients did not scrupulously adhere to the rule of giving the metops a module and a half precisely, or to making them exactly square.

In a Doric temple, at Cora in Italy, published by Piranesi, the metops of the side and middle intercolumns are not of the same breadth; also, in some ancient examples, the capital of the triglyphs is included in the module and half, and in others it is excluded; it is sometimes continued through the metop, and sometimes discontinued.

Nor does Vitruvius positively fix the height of the metops, but only says, they are as high as long. The height of the triglyphs did not always determine that of the metops, which sometimes rose higher than the triglyphs, breaking into the capital or large band above them.

In the present case, the extraordinary length of the metop is exactly equal to the height of the capital of the triglyph (each being the sixth part of a module), so that supposing that member to be included in the height of the metops, they perfectly agree with the words of Vitruvius, in being exactly as long as high.

The agreement, therefore, of the numbers of the text, with the species of intercolumniation mentioned, makes it highly probable that Vitruvius intended the metops to be of such a length, disregarding the small differences in their measures, as not being considerable enough to offend the eye; and that consequently the numbers, as generally found in the manuscripts, are perfectly right, and as intended by the author.

is regulated. The thickness of the columns is two modules; the height, including the capitals, fourteen. The thickness of the capital (a c) one module; the breadth (a b); *Fig. XXVI.* two and the sixth part of a module. The thickness of the capital is divided into three parts, of which one is for the abacus (d) with its cymatium; another for the echinus (f) with its annules; and the third for the hypotrachelion (h.) The columns are diminished in the same manner as described for Ionic columns in the third book.

THE height of the epistilium (e) with the tenia (g) and guttæ (i) is one module. The tenia is the seventh part of a module. The length of the guttæ, under the tenia, coincides with the perpendicular of the triglyphs. Their height, with the regula; (k) is the sixth part of a module. The breadth of the bottom of the epistylum answers to the hypotrachelion at the top of the columns.

UPON the epistylum, the triglyphs (ll), having the metops (m) between them; are placed; being one module and a half high, and one module broad in front; they are so distributed, that those which happen over the angle, as well as over the intermediate columns, may be perpendicular to the middle quarters thereof; two are left in the intercolumns; and in the middle intercolumn of the pronaos and of the posticus, three; for, by this enlargement of the middle interval, the approach to the image of God is rendered more commodious and free from impediment.

THE breadth of the triglyph is divided into six parts; of which, five are placed in the middle, two and a half being on either side. The middle one makes the regula or femur (n), which the Greeks call *meros*. On either side this, are the channels, sunk as if imprinted with the elbow of a square. To the right and left of these, another femur is formed, and at the extremities semi-channels are fluted.

THE triglyphs being thus disposed, the metops, which are between the triglyphs, are as high as long. At the extreme angles, semi metops are impressed, half a module broad.^{4*}

(4*) It is to be remembered that Vitruvius makes his divisions on the line whereon the columns are erected, and includes in the extent of that line the whole shaft of the angle columns; when, therefore, all the triglyphs and metops are adjusted according to the directions given, at either end of that line will remain a space equal to half a module. This is the meaning of Vitruvius, and not that the space left at the angles at the height of the frise will be half a module, as it has been usually understood by the translators; for, on account of the diminution of the shaft of the columns, the space at that height will be lessened.

Vitruvius has given us no information concerning the projection of the triglyphs from the face of the metops. In the Greek works, the face of the triglyph is always found to be perpendicular with the face of the epistylum, and the metop recedes; but in the Roman works, as in the theatre of Marcellus, and the Doric temple of Cora, the faces of the metops are perpendicular with the face of the epistylum, and the triglyphs project. For want of instruction, therefore, with regard to the quantity of the triglyphs projection, I shall follow the example of the theatre of Marcellus, in which it is nearly equal to the twentieth part of the diameter of the column.

Thus the metops, intercolumns, and lacunars, being regularly distributed, all defects will be avoided. The capital (p) of the triglyph is made the sixth part of a module.^{5*}

OVER the capital of the triglyphs is placed the corona (q), projecting the half and the sixth part of a module, having a Doric cymatium (v) below, and another (v) above. The thickness of the corona, with the cymatiums, is half a module.^{8*} In the under part of the corona, perpendicular to the triglyphs, and to the middle of the metops, the directions of the viæ (z), and the distribution of the guttæ (i), are to be so contrived, that there may be six guttæ in length, and three in breadth. The remaining spaces (y), the metops being broader than the triglyphs, are left plain, or have the sculptures of thunder-bolts. Near the edge of the same corona, a line is encafed, which is called *scotia* (λ).^{11*} The tympan, fima, coronæ, and the rest, are executed in the same manner as has been described for the Ionic order.

Fig. XVII. THE foregoing is the method for composing diastyle works; but, if the structure is to be made systyle and monotriglyph,^{12*} the front of the temple, if tetrastyle, is divided into XXIII parts; if hexastyle, into XXXV. Of these one part will be a

(5*) Whether the capital of the triglyphs is included or excluded from the module and half, allowed to their height, Vitruvius leaves uncertain; neither will the ancient examples help to determine it; some having it included, and others excluded.

(6*) Vitruvius does not inform us whether or not this projection of the corona is exclusive of the projection of the cymatiums; but judging from the examples of antiquity, and the space the guttæ in the soffite require, I think it should be understood to be exclusive. The projecture of the corona in the theatre of Marcellus is much greater.

(7*) Cymatium, in a general sense, signifies a subordinate moulding of any shape that relates to one of the principal members; what particular moulding is meant by the Doric Cymatium is not known.

(8*) Galiani has just before reproved Perault for having deviated from the text, by altering the projection of the Doric capital; and here (so unfortunate we are) has himself fallen into a similar error, having in his translation taken the liberty to add a sixth part of a module to the half module, which the text allows to the thickness of the corona; giving for reason, the general rule prescribed by Vitruvius, that the heights should be equal to the projectures; and his own opinion, that the cornice wants that increment. But these are not sufficient reasons for deviating from the express direction of the text twice repeated; and (turning his own argument against himself) as the projecture prescribed by the text, is not impracticable. Therefore, although I have a due value for his opinion in general, I think it not proper in this case to follow his example.

(9*) Vitruvius directs mutules to be made over the metops as well as over the triglyphs. This is so contrary to the custom of the moderns, that none of the preceding translators have understood the passage; not believing it could possibly have that meaning: but since the remains of the Grecian buildings have become known to us, we are no longer doubtful of its being the author's intention that mutules should be made over the metops as well as over the triglyphs, (as fig. XXVI. shews.) This also clears the succeeding passage, *reliqua spatia quod latiores sunt metopæ quam triglyphi*, which has much puzzled the commentators, and which they have all understood and explained, by their draughts, in a manner different to each other.

(10*) The Viæ, I conceive to be the intervals or spaces between the guttæ; and that they are so called because they resemble the viæ, or streets, about the islands of houses in a city. Galiani supposes them to be the margins of the pannels in the soffite of the corona.

(11*) This is a groove made to check the rain water.

(12*) Monotriglyph signifies that manner which has only one triglyph in the intercolumns.

If the metops are allowed to be no more than a module and a half broad, the intercolumns can be no more than a diameter and half wide. Wherefore, it has been generally supposed that *syssylon* has been wrote, by mistake, instead of *pyncostylon*, to which Galiani has altered the text. This point will be discussed in the following notes.

module, by which the work is to be regulated as before written. Then over every epistylum,^{13*} two metops and triglyphs^{14*} are disposed. In the angles this (species) is larger (than the former) by as much as the space of the bisected hemitriglyph.^{15*} So that there happens in the middle epistylum,^{16*} under the fastigium, the space of three triglyphs and three metops, for the

(13*) It has been before observed, that Vitruvius, in some places, considers each stone of the entablature that lays from center to center of column as a separate epistylum; as d e and e f, Fig. XVI.

(14*) This passage has been generally misunderstood and miscorrected, by the editors and translators, to two metops and one triglyph. De Laet and Galiani, following the correction of Philander, have thus given the text, *metopæ duæ & triglyphi singuli*, instead of *metopæ & triglyphi bini*, as the manuscripts express it.

It must be noted, that in describing this monotriglyph work, Vitruvius does not previously mention the triglyphs over the columns, as he has done in the description of the diastyle work. It is therefore necessary that he should, by some means, mention and include them, as well as those over the intercolumns. This he does, by describing two metops and two triglyphs over each epistylum; for from center to center of column is two metops, one whole triglyph and two hemitriglyphs, which make two of each. Those who read but one triglyph suppose no mention to be made in the text of those over the columns; which are, however, necessary to complete the number of modules which they themselves assign to the front of the temple.

(15*) Here is another erroneous alteration of the text, derived from the mistaken correction of Philander, and adopted by all the other editors. They read, *in angularibus non amplius quam quantum est spatium hemitriglyphi*, instead of *in angularibus, hoc amplius quantum dimidiatum, est spatium hemitriglyphi*, which I find in four manuscripts: and Philander has given it as the current text. This latter reading is perfectly just; for, as the manner of numbering the triglyphs and metops in this systyle work, is from center to center of column, there must consequently be a hemitriglyph left unaccounted over the angle columns; by which it happens that the space to be added at the angles is larger than in the former case, (that is, than in the diastyle work) by as much as that bisected hemitriglyph; and thus it is expressed by the latter reading: whereas the former reading, which is the false correction, expresses only, that a hemitriglyph is left at the angles; as in the former instance, which is a defective and erroneous explication; for there remains at the angles a hemitriglyph more than in the former instance.

But I find this whole passage so different from that in the common editions, that it may not be improper to transcribe it, *ita supra singula epistylia & metopæ & triglyphi bini erunt collocendi: in angularibus, hoc amplius, quantum dimidiatum est spatium hemitriglyphi, id accedat in mediano,*

habens cymatium Doricum in imo, alterum in summo, item cum cymatiis corona crassa ex dimidia, dividende autem sunt in corona ima ad perpendicularum contra fastigium trium triglyphorum & trium metoparum spatium distabit, quod latius medium intercolumnium accedentibus ad ædem habeat laxamentum & adversus simulacra Deorum aspectus dignitatem. Columnas autem stria, &c. which runs thus in translation, Over every epistylum, metops, and triglyph two of each are disposed. In the angles this (species) is larger (than the former) by as much as the space of the bisected hemitriglyph; so that it happens, in the middle epistylum (the corona having a Doric cymatium below and another above, and being, with the cymatiums, half a module thick) that the space under the corona perpendicular to the fastigium, is divided into three triglyphs, and three metops; for the middle intercolumn being enlarged, renders the entrance of the temple more spacious, and gives an appearance of dignity towards the statue of the God.

(16*) Again, where the manuscripts have *trium triglyphorum & trium metoparum*, Philander would have *duorum triglyphorum & trium metoparum*, or *trium triglyphorum & quatuor metoparum*; which last, De Laet, Barbaro, Perault and Galiani have adopted. But, as it has been before shewn that Vitruvius computes from center to center of column, the number of triglyphs and metops must of course be equal. Therefore, the original reading is more probably right; and we shall find, by the following observations, that it perfectly agrees with the other circumstances of the context.

I come now to speak of the other two numbers, viz XXIII and XXXV, which have been changed by some to *nineteen and a half*, and *twenty-nine and a half*, by others to *twenty-two* and *thirty-two*. I deferred speaking of these till after the preceding notes, that what is said thereon may be the better understood. Proceeding to prove these numbers in the same manner as the former two, I first premise that Vitruvius intitles this Systyle work; and, as he prescribes but one triglyph in each intercolumn, the metops are consequently two modules in breadth. Therefore, in the tetrastyle temple, the four columns and two lateral intercolumns make 8 diameters. The middle intercolumn, to contain the given number of triglyphs and metops of the same dimensions, will require to be 3½ diameters, which, added to the former 8, make in all 11½ diameters, or 23 modules, exactly the number mentioned by Vitruvius. It may also be computed by the number of triglyphs and metops: thus, eight triglyphs, at one module each, is 8 modules; seven metops, at two modules each, is 14 modules; which together make 22: and the two portions of metops,

enlargement of the middle intercolumn renders the entrance of the temple more spacious, and gives an appearance of dignity towards the statue of the God.

UPON the capital of the triglyphs, the corona is to be placed, having, as before said, a Doric cymatium at bottom and another at top. The thickness of the corona, with its cymatiums, is half a module. The under part of the corona, perpendicular to the triglyphs, and to the middle of the metops, is to be divided, for the direction of the viæ, and the distribution of the guttæ; all the rest are the same as has been mentioned in the diastyle species.

Fig. XXVI. THE columns are to be wrought in twenty striæ^{17*}, which, if made flat, form twenty angles, (3, 5, 7;) but, if they are hollowed, they are to be thus performed. A square (1, 2, 3, 4) is described, whose sides are equal to the interval of a stria; in the center (8) of the square, the central point of the compasses is placed, and a circular line drawn, touching the angles of the square; and that portion of the curve (2 3), which is between the lines of the circle and the square, forms the hollow of the stria. Thus the Doric column will have its proper kind of striature. With regard to the swelling which it has in the middle, it is the same as has been described in the third book for Ionic columns.

As the symmetry of the external parts of Corinthian, Doric, and Ionic temples, has been described, it is also necessary to explain the internal distribution of the cell and pronaos.

left at the angles, is another module, amounting in all to 23 modules.

The same computation also answers in the hexastyle temple; there are twelve triglyphs, which is 12 modules; eleven metops, which is 22 modules; and the portions of metops left at the angles is 1 module, which make in all 35 modules, the number of the text.

The objection is, that the metops will be half a module broader than it is supposed they should be; notwithstanding which, the exact agreement of the numbers in these two, as well as in the former two instances, with the species of intercolumniation mentioned, is a sufficient argument to prove, that, such a breadth in the metops was intended by Vitruvius in monotriglyph and systyle work, as he terms it, and especially with columns, whose thickness is the seventh part of their height; for we find, by the examples before mentioned, that the ancients did not scrupulously adhere to the rule of making the height and breadth of the metops equal; or of giving them exactly a module and an half in breadth.

Also, in the second chapter of the third book, Vitruvius says, *Columns whose thickness is the eighth part of their height, would appear gross and unhandsome if used in pycnostyle work;* much worse, therefore, would these (whose thickness is the seventh part of their height) appear in his opinion, if they were so applied: as even the small draft, Fig. XVI, evinces. All which contribute to confirm the opinion, that he never intended such application; and the perfect agreement and aptness of all these circumstances, seem sufficient to assure us of the justness of the reading as generally found in the text.

Fig. XVII. shews the Doric monotriglyph front with systyle intercolumns, as described by Vitruvius; and Fig. XVI. the same, with pycnostyle intercolumns, as altered by former editors.

(17*) In the Doric temple at Cora, before mentioned, is an example of both these sorts of striæ or channelling; the lower part of the columns having the flat, and the upper part the hollow kind of striæ. See Fig. XXVI.

C H A P T E R IV.

Of the internal Distribution of the Cell and Pronaos.^{1*}

THE temple is to be so contrived, that the breadth may be half the length; and the same cell be in length (K C) a fourth part more than the breadth,^{2*} including the wall in which the doors are placed. The remaining three parts advance to the antæ (D) of the walls of the pronaos, which antæ should be of the same thickness as the columns; and if the cell is more than XX feet in breadth,^{3*} two columns (1 2) are placed between the two antæ (D), which separate the space of the pteromatos^{4*} and the pronaos. Also, the three intercolumns which are between the antæ (D) and columns (1 2), are closed with plutei of marble, or of inside materials,^{5*} leaving therein apertures to communicate with the pronaos.

(1*) It is proper to be mentioned, as a caution, that all the translators before Galiani (who himself has made the remark) have supposed this chapter treated of a kind of temples different from those before explained, and have made their draughts accordingly; whereas it is sufficiently evident, by the reading of the context, that it treats of the internal parts of the same temples, of which the external only have been described.

(2*) I at first thought with Galiani, that the breadth here mentioned should be understood to be that of the whole temple; but several concurring circumstances obliged me to alter my opinion. Vitruvius speaks of two columns (1 2, Fig. XVIII) to be placed between the antæ D, if the breadth exceeds twenty feet; and of two others (5 6) to be placed more inward, if the breadth exceeds forty feet. This necessarily supposes a considerable distance between the antæ D and the front walls C of the cell; but, if the length of the cell is a fourth part more than the breadth of the whole temple, no such distance can happen, nor any such columns be placed, as appears by Galiani's draughts, and as may easily be proved by trial on any of the draughts of temples. Fig. XVIII, XIX, and XX. But, if the breadth mentioned is understood to be that of the cell, then the parts happen suitable to this disposition of columns, as is shewn by the plans of the peripteral temples above mentioned; which, therefore, is a sufficient evidence that it should be so understood.

This being the case, it follows, that the three parts mentioned to remain, and to extend to the antæ, must relate to the cell also; and, consequently, that the word temple (*ædis*) at the beginning of the chapter, must be understood to signify the internal temple or cell only; that is, from the columns marked 1 2, to those marked 3 4, excluding the peristyle of columns around the same. The external proportion of the whole temple has been before described in the first chapter of the third book; and the use of this chapter is professedly to explain the internal parts.

(3*) Here again the word *ædis* must be understood to mean the cell; because the placing of columns, 1 2, Fig. XVIII, between the antæ D, must be supposed to depend on the distance of these antæ from each other, and on the breadth of the cell; also, because, in peripteral temples (which are the temples in question) a breadth of twenty feet in the whole would cause the cell to be too small to require two columns to be placed in the breadth between the antæ thereof.

(4*) Pteromatos signifies the walks and ranges of columns on the flanks of the temple. See note 14, at the VIIIth chapter of this book.

(5*) Plutei was the general name of all kinds of fences. To what height these plutei between the columns were raised we are not informed; but most probably they were only pedestall high. See note 3, chapter 1, book V.

Fig. XVIII.

IF the breadth is more than XL feet, columns (5 6) are placed more inward, opposite to the columns, between the antæ, and have the same height as those in front; but their thickness is lessened according to this rule; if those in front are an eighth part of their height, these are made a ninth part; and if those are a ninth or tenth, these are made proportional; for, on account of the inclosure of the air, this diminution will not be discerned; but if they should appear thinner, the striæ, being XXIV in the exterior columns, in these must be made XXVIII or XXXII, that what is taken from the substance of the shaft may be so retrieved by the additional number of striæ as to be imperceptible: and thus columns of unequal thickness will be made to appear equal. The reason of this effect is, the eye seeing the objects more numerous and frequent, seems to pass over a greater compass; for, if two columns of equal thickness are measured round with lines, one being striated, the other not, and the line girts over the hollows and angles of the striæ; notwithstanding the columns may be of equal thickness, the lines which encompass them will not be equal, because the girt of the striæ renders one of the lines of a greater length. This being the case, it cannot be improper, in narrow and enclosed places, to make the symmetry of the columns more slender, provided we properly adjust the striæ.

THE thickness of the walls of the cell should be in proportion to its magnitude, observing that the antæ are to be of equal thickness with the columns. If they are built with small stones, they are to be regularly laid; but if squared stones or marble are used, they are generally formed rather small and equal; because the middle stones binding the middle joints, make the whole work stronger, and also the risings, occasioned by the pressure about the joints and courses, become more agreeable in appearance.

C H A P T E R V.

Of the Position of Temples according to the Regions.

THE sacred temples of the immortal Gods should be so disposed, that, if there is no impediment, and the use of the temple permits, the statue which is placed in the cell may seem to look toward the evening region of the heavens; so that those who approach the altar, to make their offerings, or perform sacrifices, may look toward the eastern sky, and to the image which is in the temple. By this means the temple, the eastern sky, the supplicants and sacrificers making their vows, and the image seeming to rise to behold them, will all be seen at one view: for it is proper that the altars of the Gods should be disposed to the east.

BUT if the nature of the place prevents that position, then the temple is to be turned to the view of the greater part of the city walls, and temples of the Gods ; or should sacred fanes be built near a river, like those near the Nile in Egypt, they should look toward the banks of the river ; so likewise, if near a public way, they should be so situated, that the passengers may behold it, and pay their salutations.

C H A P T E R VI.

Of the Proportions of the Portals of Temples.

THE rules relating to the portals of temples, and their antepagments^{2*} (E), are these : first, it is to be determined of what kind they are to be made ; for there are these kinds, Doric, Ionic, and Attic.

Fig. XXIX. and XXX. IN those of the Doric kind, these rules are to be observed : The top of the corona (A), which is placed above the upper antepagment, is made level with the top (o) of the capitals of the columns which are in the pronaos. The aperture or hypothyron is thus determined : The height from the pavement (B) of the temple to the lacunars^{3*} (C), is divided into three parts and a half, of which two parts make the height of the aperture of the door^{4*}. This (height) is divided into twelve parts, of which five and a

(1*) The Latin word *ostia*, which signifies the aperture of the door, I have rendered portal, in order to preserve the distinction between that and the framing of wood work, &c. made to close or shut the said aperture; and which is properly called the door.

(2*) The antepagments are the jambs of the door case, or perpendicular pieces of the architrave.

(3*) The lacunars have been before explained to be the cofers, or pannels. Those in the cieling of the pronaos, which are those here implied, were usually on a level with those in the soffite of the corona, as they are in the temple of Theseus, at Athens, in that of the Sybil, at Tivoli, Vesta, at Rome, and divers others. They were placed sometimes indeed at different levels, as at the top of the architrave, &c.

But, as they were originally and most usually at the level of the corona, and Vitruvius has spoken of no other than those in the corona, we must suppose that he considers these which he here mentions to be on the same level.

(4*) This passage has, by all the translators heretofore, been explained in a manner that no antique example has been found to authorise, and that has no reason of propriety or beauty to recommend it: they suppose that the corona of the cornice is intended by Vitruvius to be much more in height than all the rest of the cornice, architrave and frieze together; as A, Fig. XXIX.

Vitruvius says that the top of the corona of the portal is to be made level with the top of the capitals of the columns in the pronaos; and at the same time directs the aperture of the door to be made of such a height as causes the ar-

half make the breadth of the aperture at its bottom (B); and at the top it is contracted, if the height of the aperture is not more than sixteen feet, as much as the third part of the antepagment. If the height is from sixteen to twenty-five feet, the upper part of the aperture is contracted a fourth part of the antepagment. If from twenty-five to thirty, the upper part of the aperture is contracted an eighth part; and those that are yet higher are to be disposed perpendicular.

THE antepagments (E) are made as thick in front as the twelfth part of the height of the aperture, and are diminished at the top the fourteenth part of their thickness^{5*}. The height of the supercilium^{6*} (D) is equal to the thickness of the antepagment at the top. The

chitrave, frise, and under part of the cornice, to happen much lower; from whence it is supposed that he intends all the space between to be occupied by the corona; which consequently becomes of a monstrous and disproportionate height.

This is, as it must be universally allowed, so useless and unmeaning a deformity, and so contrary to all the known examples of the antique, that it encourages a suspicion of its not being the intention of the author, and that it is a mistake arising from some unaccountable error in the text.

I find two instances in the antique wherein the top of the corona of the portal is level with the tops of the capitals of the columns in the pronaos. These are in the Doric temple at Cora, in Italy, and in the Sybils temple at Tivoli. But, in both these examples, the height of the aperture is two parts and an half, out of three and an half, from the pavement to the lacunars; whereas Vitruvius directs it to be no more than two parts.

If the height of the aperture is allowed two and an half, B B, Fig. XXX, as in these examples; and all the other members are made in the proportions mentioned by Vitruvius; then, the top of the corona being made level with the top of the capitals, will cause the corona to be of a proper and moderate size, nearly equal with the abacus of the capitals; as figure XXX shews.

The agreement of these two examples in the same proportion, the suitableness of this proportion of the aperture to the distribution and proportion of all the other parts of the portal, the correspondence of these ancient doors in all other respects to the description of Vitruvius, joined with the incongruity and deformity that arises from the height of the aperture mentioned in the text, make it very probable that the error lies here, and that *duæ*, two, has been written instead of *duæ s.* or *duæ semis*, two and an half.

It is true that the generality of the ancient portals, which have come to our knowledge, are not so high in the aperture as those of Cora and Tivoli: several of them agree with the text, and have but two parts, out of three and an half, from the pavement to the lacunars: such are those of the temples of Fortuna Virilis, Concord, and Vesta, at Rome (according

to Palladio) and that of Pola, in Istria. But none of these are of the Doric or Attic kind; they are what Vitruvius calls the Ionic; whereas those of Cora and Tivoli are both Attic; which, as Vitruvius hereafter says, is the same as the Doric, and which latter he is here describing.

Those ancient portals, that have the top of the corona level with the tops of the capitals of the columns, do not agree with the text in the proportional height of their aperture; and those that agree in the height of their aperture have not the top of the corona level with the top of the capitals; nor can they have, unless some member of the entablature is made so unusually large and disproportionate as shocks the eye of the spectator. By these ancient examples, it appears that the Attic and Doric portals have, in their apertures, two and an half parts, out of three and an half, from the pavement to the lacunars; and the Ionic but two parts: and that the former have the top of the corona level with the top of the capitals, but the latter have not. I therefore conjecture, that Vitruvius has, in the description, inadvertently united the proportion of the Ionic portal with that singularity of the Doric, of having its corona level with the top of the capitals, or else that he has written *duæ s.* for *duæ semis*; the *s*, according to custom, standing for *semis*, which the copyists have mistakenly supposed²⁴⁴, and that thus the error has arisen. Whether or no this conjecture may be satisfactory and well founded, I submit to the decision of the public. I cannot, however, be of opinion that Vitruvius could ever intend so exorbitant and disproportionate a member as that large corona. Propriety, beauty, and the example of antiquity, conspire to decry it. In practice, therefore, it appears to me most adviseable to make the height of the aperture in Doric portals like those of Cora and Tivoli: viz. 2; to 3; and, in Ionic portals, to give the aperture the height mentioned in the text: viz 2 to 3.

(5*) Thus the portal of the Sybils temple at Tivoli, and that of Cora, are contracted.

(6*) In this place the supercilium signifies the level part of the architrave, D.

cymatium (F) is to be made the sixth part of the antepagment, and its projecture is equal to its thickness. The Lesbian cymatium (F), with the astragal, is to be sculptured. Upon the cymatium, which is in the supercilium, the hyperthyrum (G) is to be placed, in thickness equal to the supercilium, and therein is to be wrought the Doric cymatium, lesbiam, astragal, sima, sculpture (H). Then the plain corona (A), with its cymatium, is formed, and its projecture is equal to the height of the supercilium, which is laid upon the antepagments. To the right and left projectures (I) are made, as far as the footings extend; and in the ungue (K), the same cymatiums are united.

Fig. XXXI.

BUT if the Ionic kind is to be used, the height of the aperture being found in the same manner as for the Doric, the breadth is determined, by dividing the height into two parts and an half, of which one part and an half makes the breadth of the aperture at bottom. The contracture is the same as in the Doric. The thickness of the front of the antepagments (E), is the fourteenth part of the height of the aperture; their cymatium is the sixth part of their thickness. The remainder, exclusive of the cymatium, is divided into twelve parts; three of which make the first corse (a), with its astragal; four the second (b), and five the third (c). These courses, with their astragals, extend all round. The hyperthyrum is formed in the same manner as that of the Doric. The ancons (L L), or prothyrides, (as they are called) are wrought on the right and left, and, exclusive of the

(7*) The Lesbian cymatium I judge to be an ogee, or sima reverfa; because the generality of the ancient portals known to us, have this moulding for the cymatium of their antepagments; and thus it is in the portal of Cora, which in so many other respects agrees with the description of Vitruvius.

(8*) The hyperthyrum is the frise, or the frise together with the bed-mould of the cornice.

(9*) This sentence is very obscure, *Et in eo scalpendum est cymatium Doricum, astragalum Lesbium sima sculptura*. Vitruvius does not tell us in what part of the hyperthyrum these mouldings are to be wrought, nor their proportion; and it is doubtful how or what we are to understand by *astragalum Lesbium sima sculptura*.

In the portal of the temple at Cora, the mouldings at the top of the hyperthyrum, serving as the bed-mould to the cornice, are a cavetto with its fillet; above that, dentils; and upon them, an astragal enriched with beads, having a fillet above and below it. Their proportion all together is two sevenths of the height of the hyperthyrum. Vitruvius mentions no dentils, but a sima; and places the astragal between that and the Doric cymatium.

(10*) The projectures here signified are doubtless those which we call knees, made by the excursion of the cymatium at the upper part of the antepagments; for we find such projectures were frequently used in the works of the ancients, as in the windows of an ancient Ionic temple now

remaining at Athens. In those of the Sybil at Tivoli, and in the portal of the temple at Cora. In this last, the quantity of their projecture is equal to a fourth part of the breadth of the antepagment; and their extent from the top of the supercilium downward, is equal to the height of the whole supercilium, added to the height of its cymatium and fascia; so that the knee of the fascia ranges exactly with the bottom line of the supercilium.

(11*) Galiani seems to have rightly conceived this passage; the footing, or crepido, here mentioned is probably the cill, or stone, that bears the antepagments. Vitruvius, therefore, would have the knees project so far as to be perpendicular with the outside of the antepagments at bottom.

(12*) Ungue, I imagine, expresses no more than the several turns or bends of the knee.

The great projection given to the corona seems to make it necessary to have trusses (or ancons, as they are hereafter called); such trusses there are adjoining to the knees in the portal of the temple at Cora, as L L, Fig. XXX.

(13*) *The fascia*.

(14*) The trusses or consoles: those of the temple at Nisimes are, according to Palladio, formed narrower at bottom than at top, as here directed.

leaf, descend as low as the bottom of the supercilium. The thickness of these in front is the third part of the thickness of the antepagment; and, at bottom, they are a fourth part thinner than at top.

THE doors are so framed, that the cardinal scapi^{15*} (d), may be the twelfth part of the whole height of the aperture. Out of twelve parts between the two scapi, the tympan^{16*} (e) have three parts. The impages^{17*} (f) are so distributed, that the height being divided into five parts, two superior, and three inferior, are disposed. Upon the middle the middle impages are placed; of the rest, some are framed at top, and some at bottom; the breadth of the impage is the third part of the tympan; the cymatium (g) is the sixth^{18*} part of the impage; the breadth of the scapi (h) is the half of the impage; the replum (i) is

(15*) Scapi are all the pieces in general, which are disposed perpendicularly, and which we call stiles: the cardinal scapi I suppose to be the hinge stiles, or rather the door-posts to which the doors are hinged. The scapi are mentioned twice afterward; the first mentioned of the two, I take to be the middle stiles of the door; and the other, the side stiles, (*i. e.*) those next the antepagments. It is not determined whether each of the cardinal stiles is to have in breadth the twelfth part of the height of the aperture, or whether that measure is to be divided between both. I have chosen the latter: Galiani has altered *altitudinis*, in the text, to *latitudinis*, thereby making these cardinal scapi to be the twelfth part of the breadth instead of the height.

(16*) The tympan are the pannels. Perault and Barbaro make but one pannel in the whole breadth of the aperture; but the manner in which the scapi are three times mentioned, proves, that there must be at least four scapi exclusive of the cardinal scapi; and, consequently, two pannels in the breadth: and this induces me to think that the twelve parts, out of which the tympan has three, are to be understood to be in the breadth of the aperture, between the two cardinal scapi, not in the height of the aperture, of which the cardinal scapi has before had one twelfth; for, thus understanding it, the measures allowed to the tympan, scapi, &c. are reconcileable with that of the breadth of the aperture, otherwise not.

(17*) The impages are supposed to be the horizontal pieces of the framing, called by us the rails. The translators in general, excepting Galiani, have made but three in the whole height; one in the middle, and the other two at top and bottom of the door; but it is evident, by the expression of the text, *ex reliquis alii in summo alii in imo, of the rest, some above and some below*, and afterward mentioning one in the middle, that there must be at least two impages, if not more, both above and below the middle one.

(18*) The replum has been variously interpreted; but the most general received opinion is, that it is the rising part of the pannel, by us called the raising.

The twelve parts of the breadth are thus accounted for:

The two tympan, at 3 each,	-	6
The four scapi, at $\frac{1}{2}$ each,	-	2
The four replums, at $\frac{1}{2}$ and $\frac{1}{2}$ each,	-	$2\frac{1}{2}$
The four cymatiums, at $\frac{1}{2}$ each	-	$0\frac{2}{3}$
The middle astragals, or staffs, n n,	-	$0\frac{2}{3}$

In all 12

After all, I am far from being satisfied that the design given by the other translators, or myself, (though most correspondent to the text I could imagine) is to be depended on as the true formation of the ancient doors. I rather believe (founding my opinion on the circumstances of the description) that they were framed in a manner of which we have at present no idea.

We imagine the scapi are the perpendicular, and the impages the horizontal margins of the door; why then should the former be but half the breadth of the latter? We know not whether the cymatium is included, in the measure allowed to the impage, or excluded; whether it is at top of the impages only, or at bottom also; whether it projects or recedes, and whether it is to be applied to the scapi as well as to the impages; whether the middle impage is to be placed at the true middle of the height of the aperture, or that point which separates two parts above from three below. We are not informed how many impages there are to be made above and below the middle one, nor how they are to be disposed; and we know not what is certainly meant by the replum; wherefore the description conveys to us no clear idea, but is obscure and unintelligible; and the generality of the translators have therefore contented themselves with giving a draught of the doors according to their own fancy, without regard to its conformity to the words of the text.

the half and a sixth part of the impage; the scapi (k), which are nearest the antepagments, are also the half of the impage.

BUT if they are valved,^{19*} the height remaining the same, the width of the door is augmented.^{20*} If they are quadrifors, the height also is encreased.

THE Attic kind are formed according to the same rules as the Doric, but have
Fig. XXX. also corfes^{21*} (n), under the cymatiums in the antepagments, worked all round, and so proportioned as to have two parts out of seven contained in the antepagment, exclusive of the cymatium; and these doors are not made with cerostrota^{22*} ornaments, nor bifors, but valved; and they have apertures in the exterior parts.^{23*}

THESE rules, which are practised in the composition of Doric, Ionic, and Corinthian temples, I have explained as well as I have been able, according to the approved methods. I shall now speak of the composition of Tuscan temples, and of the manner in which they should be constructed.

(19*) This expression implies, that the door just described is not of the valved kind, but it does not inform us what valved doors are. Galiani supposes them to be one-leaf doors; Perault, two-leaf doors, in this place; and in the following passage, one-leaf doors. It is certain they are neither two-leaf doors, called bifors, nor four-leaf doors, called quadrifors; because Vitruvius here opposes them to both; and it is not probable that they are one-leaf doors; because Vitruvius, after having allowed an ample width for the door described, says, if they are to be valved they must be wider; which implies that they are not one-leaf doors; for it is not to be supposed that doors that have but one leaf should be directed to be made wider than those that have two or more leaves; it is rather a reason for making them narrower. Indeed, we are not told the number of leaves in this described door; but those that suppose the valved to be one-leaf doors, must suppose this to have two or more leaves; for it is evidently not a valved door, as before noted, and consequently they must suppose the one-leaf door is directed to be made wider than a door of two or more leaves, which is absurd and improbable.

The door described is probably a bifors, or two-leaved door, as Galiani conceives it; the distribution and proportion of the parts agree with such a formation; if so, and if it seems likely that, as the valved doors are directed to be made wider, they have consequently more leaves than the door described, and yet are not quadrifors; it is most probable that they are three-leaved doors, having the middle leaf hinged to one of the side leaves; and this opinion is,

in some degree, confirmed by the order in which they are mentioned by Vitruvius; for he proceeds from the door described, which is probably a bifors, to the valved, and then to quadrifors.

(20*) The words of the text, *in latitudinem adjiciatur amplius foris latitudo*, seems to encourage a notion that the breadth of the aperture is to be encreased by as much as the breadth of one door, meaning, I suppose, one leaf, as Galiani has understood it; but I do not venture to render it in that sense; because the words will equally well bear the construction I have chosen; and utility, as well as the authority of the antique, opposes such a proportion, which makes the door almost as broad as high. We find none of the doors of the ancient temples much wider than half their height, though there are several that are higher than twice their width.

(21*) The corfes of the Sybil temple at Tivoli, and those of the temple at Cora, are formed according to this rule.

(22*) Cerostrota is mentioned by Pliny as a kind of inlaid work.

(23*) Some have rendered this passage, the doors open outward; others render it as I have done. The text is, *aperturas habent in exteriores partes*: the sense depends on the acceptance of the word *aperturas*, whether it signifies apertures; or, the action of opening.

C H A P T E R VII.

Of the Proportions of Tuscan Temples.

THE length of the place (m m), on which the temple is erected, being *Fig. XXXII.* divided into six parts, one is deducted, and the remainder given to the breadth (k k). The length is divided in two parts; the interior part (m n) is assigned for the space of the cell, and that next the front is left for the disposition of the columns. The breadth is divided into ten parts; of which, three to the right and left are given for the lesser cells (a), or for the places of the wings (b); the remaining four are allotted to the middle temple (h). In the space of the pronaos (B), which is before the cells, the columns are so disposed, that those of the angles (d) may stand opposite to the antæ (c), at the extreme parts of the walls. The middle two (e), opposite the part of the walls which is between the antæ and the middle temple, are so situated, that, between the antæ (c), and the prior columns (d), in the middle of the same line, others (g) may be disposed.

Fig. XXVII. THE thickness of these columns at bottom is the seventh part of their height; their height is the third part of the breadth of the temple; and the tops of the columns are diminished a fourth part of the thickness of the bottom. Their bases (r a) are in height the half of their thickness, and have a circular plinth (r) as thick as half their height.

THE torus above, with the apophygis (a'), is as thick as the plinth. The height of the capital (k h) is half the thickness of the column. The breadth of the abacus (k) is equal to the thickness of the column at bottom. The thickness of the capital is divided into three parts; one of which is given to the plinth (k), that serves for the abacus; another to the echinus (i), and the third to the hypotrachelian (h), with the apophygis (b).

(1*) Apophygis is the fillet, or square, that terminates the shaft of the column at the top and bottom. In the 1st chapter of this book, it is called apotheosis. Philander and Barbaro have added *astragalo* to the text, where only *apophygis* is mentioned; in which they are followed by Perault and Galiani, they believing that the apophygis there mentioned is the fillet, c. Fig. XXVII, at the bottom of the hypotrachelion, or rather at the top of the column. Nevertheless, I am of the opinion of Palladio, that it here means the fillet, b, under the echinus; and I judge that Vitruvius

has purposely avoided mentioning the astragal and fillet, d, at the top of the column, as being no part of the capital: for in describing the Doric capital at the third chapter of this book, he also omits mentioning the same astragal and fillet.

At the first chapter of this book, where he describes the Corinthian capital, he speaks of such an astragal as being at the top of the shaft of the column, but does not describe its proportion; we may therefore conclude, that though he allows of its use, he considers it as a part of the shaft, and no ways belonging to the capital; for which reason he makes no

UPON the columns the compacted beams (e) are laid, being in height as much as the magnitude of the work may require, and in thickness equal to the hypotrachelium at the top of the columns. They are to be joined in such a manner with mortise and tenon, as to leave a vacancy of two digits (1 inch and $\frac{1}{2}$) in the joints; for, if they touch, and admit not the air between them, they ferment, and quickly decay. Over the beams, and over the walls, the mutules (f) are projected the fourth part of the height of the columns, and antepagments^{4*} are fixed in their fronts. Upon these the tympan of the fastigium is built, either of masonry or timber; and thereon, the fastigium, columnen, canthers, and templat^{5*}s, are so disposed, that the gutters of the whole roof may correspond in a triple number^{6*}.

mention of it in describing the capital; for these reasons, I believe the apophygis here mentioned cannot be that below the capital, but that under the echinus within the capital.

We find the astragal and fillet, or apophygis, d, at the top of the shaft of columns, generally used in the Roman works, though not always in those of the Greeks; as, therefore, their use is authorized, and Vitruvius has omitted to give us their proportion, I shall copy them from the Theatre of Marcellus, in which the proportion of the astragal and fillet together is the fifteenth part of the diameter of the column.

(2*) These walls I conceive to be the lateral and back walls of the temple; which, therefore, should be built up to the level of the top of the beams, which lie over the columns, in order that the mutules may be upon a level all round the temple. Several of the translators have understood them to be walls built upon the beams, by way of frise; without any reason for such opinion, more than what is here mentioned. But, if that had been the case, I think Vitruvius would not have failed to particularize their situation and height, because they materially affect the aspect and proportion of the temple.

(3*) None of the translators have been able to prevail on themselves to believe that the mutules are intended to project so far as is equal to a quarter of the height of the columns. Wherefore Galiani has supposed it should be read a quarter of the thickness of the columns, and accordingly has altered the text from *altitudinis* to *Intitudinis*. But, if they had seen our church in Covent-Garden, the work of the famous Inigo Jones, they would not have been so dubious of the meaning of the text. In the ordination of this church, it seems as if Inigo Jones had intended to put in practice the rules given by Vitruvius for the construction of Tuscan temples.

(4*) What is here meant by the word antepagments is uncertain; Galiani thinks it means ornaments in a general sense; it may signify some moulding affixed to the fronts of the mutules, like those of the antepagments or architrave of doors, as g, Fig. XXVII; or, as I observe, no mention is made of any corona, &c. to cover the mutules (which, nevertheless, is absolutely necessary and indispensable;) it may be some mouldings lying above the mutules, and appearing like a cornice, as Piranesi, has represented it in his *Magnificenza di Roma*.

(5*) These timbers have been before explained at the second chapter of this book.

(6*) This passage is very obscure and variously understood; *ut stilicidium terti absolute et tertiaro respondeat*.

The interpretation that occurs to me is, that the waterspouts, which are to discharge the rain from the roof of the temple, are to be three in either flank answering each other, as i, k, l, fig. XXXII, and which fall very aptly over the columns, ante, and middle, of the cell, at equal distances; as in other temples, they have been described to be in the lions heads over each column in the flanks. Galiani supposes these words import, that dripping eaves (as our workmen call them) are to be formed on three sides of the temple, the back part of the roof being sloped like the flanks; and Perault, and others, have supposed the word *tertiaro* (following the signification of that word as given in Baldus's dictionary) to mean the pediment or hips of the roof; translating the passage to this effect, *the slope of the roof is to agree with the pediment*; and Perault has added, without any authority, *which ought to be much elevated*. By this interpretation, they entirely neglect the word *stilicidium* (i. e. the gutters or channels;) which appears to me to be the principal in the sentence; for it is the gutters which Vitruvius says should correspond in *tertiaro*; a word relative to the number three; the passage, therefore, plainly signifies that the gutters are in some manner to correspond in that relation.

Fig. XXXIII. THEY also erect round temples, of which some, built with columns, without a cell, are called monopteral^{7*}, and others peripteral^{8*}. Those which are made without a cell, have a tribunal and an ascent (a), equal to a third part of their diameter. Upon the stylobata (a), the columns are raised, equal in height to the extreme diameter of the walls of the stylobata; their thickness is the tenth part of their height, including the capitals and bases. The epistylum is in height equal to half the thickness of the columns. The zophorus, and the other members which are placed above, conform to the rules written in the third book.

Fig. XXXIII. BUT if these temples are to be made peripteral, two steps (b), and the stylobata (a), are built at the bottom; then the wall (c) of the cell is made receding from the stylobata, about the fifth part of the breadth^{9*}; and at the middle of the approach is left the place of the doors (d). The cell (e), exclusive of the walls, is equal in diameter to the height of the columns above the stylobata. The columns around the cell are formed according to the same proportions and symmetry as has before been mentioned. The proportion of the roof in the middle is such, that half the diameter of the whole work makes the height of the tholus (g), exclusive of the flower^{10*}. The flower, without the pyramid^{11*},

(7*) Monopteral signifies having but one wing or aisle.

(8*) The tribunal and ascent, here mentioned, is evidently the pedestal, or podium, upon which the columns stand; for immediately after it is called stylobata. There was, no doubt, a flight of steps in the front to ascend this podium, though Vitruvius gives us no information concerning them; but Piranesi, in his *Magnificenza di Roma*, gives us a representation of a temple of this kind, which he discovered on an ancient fragment, in the Villa Medici at Rome, where the steps appear to be raised between the two front columns; also Palladio and Serlio, who drew the Sybils temple at Tivoli many years past, have placed the steps in the front intercolumn; and the present ruins of that temple evince that they could have been in no other place, or have extended farther; the podium mouldings still remaining under the column adjoining to the front intercolumn: I have accordingly represented the steps in that manner, in my draughts, *Fig. XXXIII and XXXIV*. The text very clearly expresses that the height of this tribunal, or podium, is to be equal to the third part of its diameter, as it is found in the examples above-mentioned; yet, (for what reason I know not) none of the translators have conformed thereto in their draughts.

(9*) Vitruvius says about the fifth part. In the Sybils temple at Tivoli, and in the temple of Vesta at Rome (both of them round temples of this kind) the recess of the wall of the cell, from the front of the stylobata, is equal to a third part of the height of the columns; so that when the diameter of the cell, including the walls, is made equal to the height of the columns, as it is in the Temple of Vesta, the said recess is exactly a fifth part of the whole diameter.

(10*) The tholus is the cupola, or dome; it sometimes signifies the center stone or ornament in the crown of the dome. Concerning the figure of the dome of the cell, which appeared above the entablature of the columns, we can draw no information from the antique, that part of the temple at Tivoli being destroyed; but there is a part of the wall of the cell still left, which rises above the level of the cornice, and which shews no inclination from the perpendicular like the arch of a dome; so that the springing of the dome must have been above that part, if any dome there was; for in the relievo of the monopteral round temple, in the villa Medici, there is no dome, but a blocking, or plinth, upon the cornice; and above that, a roof, like that of the Tower of the Winds at Athens; the stones that formed the roof being, in the same manner, cut into the figure of tiles.

(11*) We know not the figure of the flower here mentioned; but, as it is said to be of the size of the capitals of the columns, it may also have been of a similar shape; for thus it was found to have been in the Temple of the Winds at Athens, according to Mr. Stuart.

The temple of the Sybil at Tivoli, agrees very aptly, in so much as remains of it, with the description here given; that of Vesta at Rome is also very similar; but, in this latter, the diameter of the cell, including the walls, is equal to the height of the columns; whereas in the former the cell is of that diameter, exclusive of the walls; therein conforming to the rule here given; Vitruvius has mentioned the thickness of the wall of the cell, in the temple at Tivoli above-mentioned, it is of the same thickness as the columns around it.

is equal in size to the capital at the top of the columns. All the other parts are to be made according to the proportions and symmetry already described.

With the same symmetry, temples of other kinds, and of different dispositions, are produced; such as, the temple of Castor, in the Circus Flaminius; and that of Vejovis, between the two groves; or as the more ingenious temple of Diana of the Woods, having additional columns to the right and left, on the flanks of the pronaos. The temples that were first built of the kind like that of Castor in the Circus, was the temple of Minerva in the citadel^{12*} of Athens, and of Pallas, at the promontory of Sunium in Attica; for the proportions of these are not different, but the same; the length of the cells being double the breadth; and the other exifona^{13*}, which are usually in the fronts, are transferred to the sides.

SOME also taking the disposition of the columns of the Tuscan kind, use them with the ordination of Corinthian and Ionic works; for, by erecting two columns, in the places where the antæ procur into the pronaos from the walls of the cell, they render the Tuscan and Grecian works of common principles.

Fig. XVI. OTHERS, removing the walls of the cell to the intercolumns of the pteromatos^{14*}, and XVII. by that removal of the walls, render the chamber of the cell more spacious; and by preserving the same proportions and symmetry in the other parts, produce another kind of temples, named *pseudoperipteros*^{15*}. Temples of this kind are appropriated to the use of sacrifices; for the same kinds of temples are not erected indiscriminately to all the Gods, because the sacred rites performed to each are different.

(12*) Here, as well as at the first chapter of the second book, the word *arce* has evidently the signification of citadel; at the twelfth chapter of the fifth book, it signifies dams or fences.

(13*) We are ignorant of the meaning of the word *exifona*, it not being used by any other author. In the draught of this temple of Minerva, given by Le Roi, in his Ruins of Greece, we find nothing singular in the flanks that is transferred from the front. The columns, entablature, &c. on the flanks, have the same form and proportion as those in the front; the word (*exifona*, therefore, may signify nothing more than the proportions, and ordination of the building in general; for Vitruvius, having just mentioned the proportions of the cell, immediately after adds, & *uti reliqua exifona, the other exifona*.

This temple, according to Le Roi, has eight columns in front and seventeen in the flanks, including those at the angles; and there is another range of six columns, behind the front columns, forming a kind of double portico; the porticus is also built in the same manner; but the propor-

tion of the cell is not as Vitruvius has described it, being much longer than double its breadth. There is, however, an ancient temple at Pæstum of this kind, whose cell is in length twice its breadth exactly. See *Major's Ruins of Pæstum*.

(14*) This passage evidently proves that the word *pteros* does not signify the whole circuit of the peristyle round the cell, as Galiani supposes: for in the ancient pseudodipteral temples still remaining (which are those of Concord, Fortuna Virilis, and that of Nîmes in France) we find the space of the pronaos left open, and not engrossed by the cell, as the space of the walks in the flanks and porticus were; it therefore can only signify the walks on those three sides; but it more probably only means the walks in the flanks, because that in the back front was particularly distinguished by the name of porticus. As, therefore, pronaos and porticus were the common names of the walks in the front and rear, so pteromatos was probably the name of those in the flanks.

(15*) Pseudoperipteros (*i. e.*) false winged round.

THUS I have explained the rules of all kinds of temples as they have been imparted to me; and have distinguished their order, the symmetry of their parts, wherein they are different in figure, and in what each respectively differs, as well as I have been able. I shall now speak of the altars of the immortal Gods, and of their proper disposition for the rites of the sacrifices.

C H A P T E R VIII.

Of the Altars of the Gods.

ALTARS should regard the east^{1*}, and be always placed lower than the statue which is in the temple, that the supplicants and sacrificers may look upward to the divinity, and stand, as decorum requires, at a different height to the God. The heights of altars are so adjusted, that those of Jupiter, and all the celestial Gods, may be disposed as high as convenience will admit. Those of Vesta, and the Gods of the earth and sea, are situated lower. By these instructions the disposition of the altars in the middle temples^{2*} may be properly contrived.

IN this book is explained the composition of temples. In the following we shall give the rules for the distribution of public buildings.

(1*) Vitruvius has told us, at the fifth chapter foregoing, that altars should face the east, and that the statue should face the west, so that the altar and statue faced different ways; yet, he there says, the sacrificers look toward the statue and to the east, and that the statue faces them; this is irreconcilable and contradictory; so that, I imagine, we must understand, by the words *aræ spectent ad orientem*, that the altars should be situated at the east end of temples, and consequently face the west.

(2*) I have translated *in mediis ædibus*, in the middle

temples, as I think the words import; meaning thereby the cell of the temple, not the middle of the temple, as Galiani reads it; for it is more probable that the altars were placed toward the end opposite to the entrance; by that means leaving more room for the sacrifices, causing the whole assembly to stand before the image of the God, not partly behind it, and giving to the whole an appearance of more dignity. Also, the note foregoing helps to determine the point, for by that it appears probable that they were placed on the east side.

THE END OF THE FOURTH BOOK.

T H E
A R C H I T E C T U R E
O F

M · VITRUVIUS · POLLIO.

B O O K T H E F I F T H.

P R O E M.

M A N Y authors, O Emperor ! who, in voluminous works, have written of ingenious arts and inventions, have given great and singular reputation to their subject; would also that our art might be here so explained, that its reputation might, by these precepts, be augmented ! But all that may be desired is not easily obtained ; for architecture cannot be treated like history or poetry. History, of itself, engages the attention of the reader by the variety and novelty of the relations. Poetry also, by the measure and cadence of the verses, the agreeable disposition of the words and sentences, and the just pronounciation of the lines, allures the senses of the reader, and entices him, without seeming tedious, to the conclusion of the poem. But this cannot be done in writing of architecture ; because the peculiar terms of the art being unusual, render the sense of the discourse obscure. The terms therefore being of themselves abstruse, and withall being uncusomary, if the various precepts are not contracted, and briefly and clearly explained, the discourse will be often unintelligible, and the reader uncertain of its meaning.

In speaking therefore of the unknown names and measures of the members of buildings, I briefly express them, that the mind may conceive and the memory retain them more easily ; considering also, that the attention of the citizens is sufficiently engaged by the public affairs

of the city, as well as their own private concerns, I judge it proper to write briefly, that, in their small intervals of leisure, they may soon read and understand the subject. Pythagoras, and those who followed his opinions, chose to write the precepts of their doctrine in a cubical disposition, the cube being constituted of CCXVI verses, of which, they maintain, each precept should occupy no more than three.

THE cube is a figure of VI square equal sides, so that being thrown, on which side soever it falls, it remains steadfast and immovable, till it is removed by force; such are the dice which the gamesters throw on hollow tablets. Hence the comparison seems to be derived; for this number of verses, like the cube, fixes steadfastly in the memory that which soever meets the senses. The Greek dramatic poets also divide the action of the fable in such a manner, that the parts have a cubical relation to each other, interposing the songs of the chorus, to give respite to the pronunciation of the actors. As therefore our ancestors have used such methods, and as the subject on which I write is to many unknown and obscure, I think it most proper to describe it in short books, that it may be more easy to the understanding of the reader. The subjects are likewise so arranged, that those of the same kind are explained in one place, and not separately disposed; for thus they will more readily be comprehended.

IN the third and fourth books I have explained, O Cæsar! the proportions of temples; in this, I shall treat of the proper disposition of the public buildings; and first of the forum, because therein the magistrates regulate both public and private affairs.

(*) The cube of 6. See note 6, chap. I. book III.

C H A P T E R I.

Of the Forum.

THE Greeks make their forums square, with large double porticos, the columns close together, and adorned with stone or marble epistyliums, making ambulatories in the upper stories: but the cities of Italy follow not the same method; because, by ancient custom, the shews of gladiators are usually given in the forum. For this reason the intercolumns around the area are made wider; and in the surrounding porticos the shops (a) *Fig. XXXV.* of the bankers are disposed, with galleries in the upper floors, properly adapted for the use and management of the public revenue.

THE magnitude of the forum (A) should be suitable to the number of the people, that it may not be too small for use, nor, on account of the scarcity of people, appear too large. The proportion is so determined, that the length being divided into three parts, two are given to the breadth: for thus it will be of an oblong form, and convenient for the use of the shews.

THE upper columns are made a fourth part less than the lower; because, as the inferior sustains the greater weight, it should be stronger than the superior: also, because it is proper to imitate nature; for, in straight growing trees, such as the fir, cypress, and pine, there are none thicker at the top than at the root; and, as they grow in height, they gradually diminish to the uppermost point. Following therefore the example of nature, it is proper that the superior should be made less than the inferior, both in height and thickness.

THE basilica (B) should be adjoined to the forum on the warmest side, that the negotiants may confer together, without being incommoded by the weather. The breadth is not made less than the third, nor more than the half of the length, unless the nature of the place opposes the proportion, and obliges the symmetry to be different. But if

(i*) Galieni remarks that this proportion alludes to the middle division, or nave, exclusive of the portico on either side; because the Basilica, Vitruvius afterwards describes of his own designing, does not otherwise conform to his own rule.

On the contrary, I am of opinion that the whole extent of the basilica is here meant, and that the basilica designed by Vitruvius was an exception to the general rule;

for, after having described the common basilicas, he says, *Neither will basilicas, like that at Panum, which I designed and conducted, have less dignity and beauty:* which words clearly indicate it to be of a different form and proportion from those he had been describing. The draught I have given is of that at Panum, which is hereafter described; the simplicity of the others render them easily conceivable by the verbal description.

the basilica has too much length, chalcidicæ^{2*} are made at the ends, as they are in the basilica of Julia Aquiliana. The columns of the basilica are made as high as the porticus is broad. The porticus is the third part of the space in the middle. The upper columns are less than the lower, as above written. The pluteum^{3*}, which is between the upper columns, should also be made a fourth part less than the same columns, that those who walk in the floor above may not be seen by the negotiators below. The epistylum, zophorus, and coronæ, are proportioned to the columns, in the manner explained in the third book.

Fig. XXXV.

NOR will basilicas of the kind of that at the colony of Julia of Fanum, which I designed and conducted, have less dignity and beauty; the proportions and symmetry of which are as follows: The middle testudo^{4*} between the columns is CXX feet long, and LX feet broad. The porticus (b) around the testudo, between the walls and columns (c) is XX feet broad. The height of the continued columns (c), including their capitals, is L feet, and the thickness five, having behind them parastatæ (d) XX feet high, two feet and a half broad, and one foot and a half thick, which sustain the beams that bear the floors of the porticos. Above these are other parastatæ (e) XVIII feet high, two feet broad, and a foot thick, which also receive beams sustaining the canthers of the porticos, which are laid below the roof of the testudo: the remaining space (f) that is left between the beams which lay over the parastatæ, and those which lay over the columns, is left open in the intercolumns, in order to give light. The columns in the breadth of the testudo, including those of the angles to the right and left, are four; and in the length, on that side which is next the forum, including the same angle columns, eight. On the other side, there are but six columns, including those of the angles, because the middle two on this side are omitted, that they may not obstruct the view of the pronaos (C) of the temple of Augustus, which is situated in the middle of the side wall of the basilica, looking toward the center of the

(2*) Various are the conjectures concerning the chalcidicæ and their use, but none can be depended on, because there are no data from which any inferences may be drawn; from what is here said of them, we can draw no farther knowledge than that they were some kind of apartments separated by a partition at the ends of the basilica.

(3*) In the seventh chapter of this book, it evidently appears that the pluteum is some part between the cornice of a lower order and the columns of an order immediately above, and its height is the two ninths of the height of the incumbent columns: also, in the said chapter, the continued pedestal at the bottom of the scene, called pulpitum, is afterward referred to by the name of podium and lower pluteum. These circumstances demonstrate that the pluteum is a kind of podium. This podium is here described to be between, not under, the columns, and it is to be a fourth part less than the said columns. Whether less in height or in thickness is not mentioned; but most probably the former is meant, considering the purpose it is to answer. In this case, its height is nearly equal to that of the columns,

which height greatly exceeds the proportion usually given to a podium; but as Vitruvius, in his description of the parts of the orders, makes no mention of the proportion of the stylobatæ or podium, it may be supposed the proportions of these things were unlimited, and depended wholly on the option of the designer, or their particular use. This is confirmed by the examples of the antique, in which they are found of all proportions, from a third to a sixth part of the height of the incumbent column. In this latter proportion they are seen, in the remains of the Poikile at Athens. And in the scene described by Vitruvius, at the seventh chapter of this book, the lowest podium, or pulpitum, is a third part of the height of the incumbent column: the middle podium is two ninths, and the upper one a seventh part of the said height.

(4*) By the middle testudo is to be understood the middle part, or nave, which, from this expression may be supposed, to be vaulted above, in a flat arch, like the back of the testudo or tortoise; for the Romans distinguished such kind of arches by that name.

forum (A) and temple of Jupiter (H.) The tribunal (g) in this building is formed in the figure of a hemicycle: the extent of this hemicycle in front is XLVI feet, and the recess of the curvature inward XV feet, so that those who attend the magistrate obstruct not the negotiants in the basilica.

UPON the columns, the compacted beams, (h) made from three timbers of two feet, are placed around; and these, from the third columns (c) which are in the interior part, are returned to the antæ (i) that procur from the pronaos, and on the right and left touch the hemicycle.

UPON the beams, perpendicularly to the capitals, the pilæ (k) are placed, three feet high and four feet broad, on every side. Over these, other beams (ll) well wrought from two timbers of two feet, are placed around; upon which, the transræ and

(5*) The tribunal built by Romulus, in the forum, is said to have been in the figure of an half moon. At chap. VII. book IV. Vitruvius calls the prodium, under the columns of round temples, a tribunal; hence we may infer, that the hemicycular tribunal here mentioned, was an erection in the nature of a podium, large altar, or pedestal.

(6*) Hemicyclus is usually accepted in the sense of semi-circle; but the proportion here assigned it proves that the word cyclus was not applied solely to a perfect circle, but was expressive of every kind of rotund figure, whether circular or elliptical.

The proportion here mentioned very nearly agrees with that of the cycloid, a curve formed by a point, in a wheel, rolling one revolution, and consequently whose base line is to its altitude, as the circumference is to the diameter of a circle, and as is very nearly 46 to 15; this curve, however, is thought to have been unknown to the ancients, and was first noticed among the moderns by Father Merfennus, and annalized by Des Cartes.

(7*) Galiani supposes these three timbers were disposed altitudinally, making an architrave of six feet high, which is much too large for the columns, and beyond all example.

Perault supposes a mistake in the text, and that four, instead of three, timbers should be read, supposing them to have been disposed, two altitudinally and two latitudinally, so as to form a square of four feet. But, without regarding whether they were disposed altitudinally or latitudinally, though my opinion leans to the latter, I suppose the architrave, both in height and breadth, to have been of its due proportion, and that from these timbers it was wrought and reduced to that proportion which ever way they were disposed; for Vitruvius says, *Ex tribus tignis bipedalibus*, thereby implying, that the beam was wrought to its proper size out of or from these three timbers; supposing them, therefore, to have been placed latitudinally, they must have been reduced from 6 feet to 4 feet 5 inches and $\frac{1}{2}$ (the size of the neck of the column) including the void of two inches to be left between each timber. In altitude, I suppose each timber to have

been of such a measure as was sufficient to form the height of the architrave; for in describing the Tuscan order, at Chap. VII. Book IV. Vitruvius says, *The compacted beams are to be in height as much as the magnitude of the work may require, and in thickness equal to the top of the column.* See h, Fig. XXXV, and in section B B.

(8*) By these words, either the beams which are placed upon the columns, or the antæ of the pronaos of the temple of Augustus, are said to touch the hemicycular tribunal on either side; it is no matter which is allowed, because the beams are described to extend no farther than the said antæ. Hence the tribunal could have been situated no farther back than the said antæ, nor forwarder than the columns of the testudo. But all the preceding translators, not thinking it possible (as I suppose) that the tribunal could have that situation, without obstructing the view of the temple of Augustus (because they imagined the tribunal to have been a recess formed in a high wall) have placed it at the farther end of the temple, at a great distance from the basilica; and Perault has added a few words to the text, to make it bear that construction. But it cannot be admitted, the basilica, being the court of justice, is the proper place for the tribunal; and, beside, the words, *ut eos qui apud magistratus starent negotiantes in basilica ne impedirent* (so that the negotiants in the basilica are not obstructed by those who attend the magistrates) strongly imply, that the tribunal was attached to, or in the basilica; for it is attributed only to its *curvilinear* recession, that it did not obstruct the negotiants in the basilica.

The tribunals have been before said to be a kind of large pedestal; and therefore, being of no great height, could not obstruct the view of the temple of Augustus, although placed before it. My opinion therefore is, that the tribunal was situated as shewn by g, fig. XXXV.

(9*) These pilæ seem to have been a kind of blockings, lying upon the beams or architrave, in the place of the frise, and which supported other beams or plates that lay in the place of the lower part of the cornice. See k, in the section marked B B.

capreols, being placed coincident with the ^{10*}zophorus, antæ, and walls of the pronaos, sustain one culmen ^{11*}(m) the whole length of the basilica, and another (n) transversely from the middle over the pronaos of the temple: so that it causes a double disposition of the fastigium, and gives an handsome appearance to the roof on the outside, and to the lofty testudo within. Also the omission of the ornaments of the epistylum, and of the upper columns and plutei, diminishes the labour of the work, and saves great part of the expence. The columns likewise being carried in one continued heighth up to the beams of the testudo, encreases the magnificence and dignity of the work.

C H A P T E R II.

Of the Treasury, Prison, and Curia.

THE treasury (E) prison (F) and curia ^{12*}(D) are adjoined to the forum, *Fig. XXV.* and are to be of such a magnitude, that their symmetry may correspond thereto. The curia chiefly, is first to be made suitable to the dignity of the community or city; and, if it is square, its heighth is to be equal to once and an half of its breadth; but, if it is oblong, the length and breadth being added together, the half of that united sum is given to the heighth, up to the underside of the lacunars: also, at the half of the heighth, the walls are encompassed with coronæ of wood or plaister; for otherwise, the voice of the speakers ascending to the top, would not be heard by the audience; but, when the walls are encompassed with a cornice, the voice, being reflected before it is diffused in the air above, will be rendered sensible to the ears of the assembly.

(10*) The transtræ and capreols have been before mentioned to be the principal rafters and braces. They are said to be coincident with the zophorus; from whence, I imagine, it is to be understood, that they rested perpendicularly over the blockings or pilæ, which were disposed in the place of the zophorus, or frise.

(11*) The culmen is the horizontal piece of timber in the ridge of the roof, which we call the ridge-piece. See note 1*. chap. II. book IV.

(12*) Galiani remarks, that it is not easy to conceive what is meant by *duplex fastigiorum dispositio*, a double dispo-

sition of the fastigium. The fastigium being the triangle or pediment of the roof, continued through the whole length of the building, the ridge of which is the culmen, and it being said there are two culmens, one extending the whole length of the basilica, and another transversely from the middle over the pronaos of the temple, which therefore must cross the former at right angles, exactly in the middle of the basilica, there consequently happens a double fastigium, the one extending over the length of the building, the other over the breadth, intersecting each other in the middle, B, of the basilica.

(1*) The curia was an hall or apartment, in which the senate, or legislature of the state, assembled.

C H A P T E R III.

Of the Theatre and its Situation.

WHEN the forum is finished, then a healthy situation must be sought for (according to the rules given in the first book) wherein the theatre may be erected, for the purpose of exhibiting the sports on the festival days of the immortal Gods. For the spectators, with their wives and children, being detained in their seats by the entertainment of the games, and the pores of their bodies being opened by the inactive pleasure, readily imbibe the air; which, if it comes from fens, or other noxious places, breeds hurtful humours in the body; but if the place of the theatre is chosen with due care, such evils will be prevented. The intense heat of the meridian must also be guarded against; for when the sun fills the compass of the theatre, the air being confined therein, and prevented from circulating, becomes adust and fervid, extracting and diminishing the juices of the body: so that those dangerous expositions are to be carefully avoided.

Fig. XXXVI. If the foundation happens to be on a hill, the work will be more easily done. But if necessity obliges it to be erected in a plain, or in a marshy place, the piling and substructure must be executed in the manner described in the third book for the foundations of temples. Upon the foundation, the ^{1*}degrees (a) are raised with stone and marble. The ^{2*}precincts (b) are made proportional to the height of the theatre, and are no higher than the passage of the precinct is broad; for, if they are higher, they reflect and obstruct the voice from rising to the upper parts, not permitting the terminations and exact significations of the words to reach the ears of such of the audience as are seated

(1*) The degrees are the seats of the theatres, raised in form of steps, one above another.

(2*) The precincts are the passages or landing places between the ranges of seats, as b b, *Fig. XXXVI.* Vitruvius says they should be no higher than broad; but it is remarked by all the translators in general, that they cannot be of equal height and breadth; for as Vitruvius gives the degrees a proportion of about twice their height in breadth, and says a straight line, c d, should touch all their edges, from top to bottom, the precincts must consequently have the same proportion as the degrees. This will certainly be the case, if the floor of the precinct is supposed to be on a level with the adjoining degree (e); but if the floor of the precinct is sunk a little below that degree, as it seems proper it should be, in order that those who pass to and

fro, in the precinct, may not tread on those who are there seated; then the precinct may have the proportion Vitruvius describes; for, if the floor of the precinct, b f, is sunk so much below the said degree as is equal to the height of one degree, and the clear breadth of the precinct is made equal to the breadth of two degrees, it will happen that the passage of the precinct, b f, will be exactly equal to its height, f g, on the supposition that the degrees are made exactly twice as broad as high. With regard to proportioning the precincts to the height of the theatre, as Vitruvius mentions, I imagine it is to be understood to allude to their number, which is necessary to be greater in large and high theatres than in smaller, for it cannot allude to their magnitude, which is necessarily fixed in all theatres by the limited measure of the degrees.

above the precincts. It is also to be so contrived that a line (c d) being extended from the lowermost to the uppermost degree, may touch the edges and angles of all the degrees from top to bottom, so that the voice may not be impeded.

THE entrances should be numerous and spacious, the superior not connected with the inferior, but to all parts made direct, uninterrupted, and without intricacy, that, when the people are dismissed from the shews, they may not be crowded in departing; but have, from all parts, a separate and unobstructed ^{3*}egress.

It is also carefully to be observed, that it be not a place that stifles the sound, but such wherein the voice may freely expand. This will be effected, if a situation where there is no impediment to resonance is chosen; for the voice is flowing breath, and becomes sensible by the percussive of the air, which it actuates in an infinite number of circles; in like manner as in standing water, when a stone is cast therein, innumerable circles of waves arise from the center, and expand to a great breadth, unless they are interrupted by the narrowness of the place, or some obstacle suffers not the impression of the waves to arrive at the end; for when they are interrupted by obstacles, the first recoiling disturbs the impressions of the succeeding. Upon the same principle the voice acts, and causes such circular motions in the air; but in water the circles move only superficially in a level plane; whereas, in air the voice not only expands superficially, but also ascends gradually in height. As therefore in the impressions of the waves in water, so is it in the voice, when no obstacle impedes the first, neither the second nor the ensuing are interrupted; but all, without reverberating, reach the audience, from the lowest to the highest parts.

THE ancient architects therefore, following nature, and considering the ascending property of the voice, thus established the degrees of theatres, and contrived, by the principles of mathematics and music, that howsoever the voice might be on the scene, it should nevertheless arrive clear and melodious to the ears of the audience. For as, by instruments of brass or horn, the sounds of the chords and diases are rendered clearer, so the ancients contrived to strengthen the voice by the harmonic construction of the theatres.

(3*) Vitruvius gives us no farther information concerning the stair-cases and passages, that led to the several stories or parts of the theatre, nor of its external construction. I have, therefore, supplied this deficiency from the remains of the theatre of Marcellus at Rome; which, as being one of the most celebrated theatres of the ancients, built, and subsisting in perfection, at the time of Vitruvius, I have chosen as my model; copying from thence whatever does not oppose the instructions of Vitruvius; and in this I have followed Pi-

ranesi, who seems to have measured the ruins himself. The plan given by Desgodetz, being evidently false, he not having measured it himself, but copied it from a plan said to have been taken by Baldefari, the architect, who built the palace at present standing on the ruins of that theatre. Serlio has also copied the same plan; which is so erroneous, that, even in the number of piers and arches that surrounded the theatre, and which may at present be easily discovered, it is not conformable to the original.

C H A P T E R IV.

Of Harmony.

HARMONY, or the science of music, is obscure and difficult, especially to those who are unacquainted with the Greek language; for, in explaining it, it is necessary to make use of the Greek terms; because some of them have no Latin appellations. I shall, therefore, as intelligibly as I am able, make some translations from the writings of Aristoxenes, and subjoin his diagram and intervals of sounds, that those who will attentively peruse it may understand it more easily.

(1*) In order to render this chapter more intelligible, it is necessary to give a short account of the ancient music, referring the reader to the diagram, fig. XXXVIII, to facilitate the conception thereof.

The ancients had eighteen notes or tones, which were contained within two octaves; but they divided their scale or diagram of notes, into tetrachords, or half octaves, being systems of four notes each. Tetrachords were either conjunct or disjunct. Conjunct when the highest note of the preceding tetrachord was the lowest note of the succeeding tetrachord, making but seven notes in the two tetrachords. But, as in this case a note was wanting to complete the octave, they were obliged to add a note below the first tetrachord, to make the full octave or eighth, which additional note they called *proslambanomenos*. Tetrachords were disjunct, when the lowest note of the succeeding tetrachord was one tone distant from the highest note of the preceding tetrachord; thereby making the octave complete.

Originally, the two octaves contained no more than four tetrachords; but the ancients, afterward finding that the third tetrachord was imperfect, and that its first note, *paramese*, did not agree in fourths with the *parhypate* of the second tetrachord, owing to its being a disjunct tetrachord, and consequently a full tone being between the *mese* and *paramese*, they were obliged to contrive another third tetrachord, which should be conjunct, or a tone lower than the former, to be made use of occasionally, when the harmony required it. For this reason, we find two tetrachords; viz. *synemmenon* and *diezeugmenon*, intermixed together at the beginning of the second octave. The names of the tetrachords are, *hypaton*, or the first; *mese*, or the middle; *synemmenon*, or the conjunct; *diezeugmenon*, or the disjunct; and *hyperbolæon*, or the highest: the notes or names of the tones, in the first tetrachord (previously naming *proslambanomenos*) are *hypate hypaton*, *parhypate hypaton*, and *lichanos hypaton*. In the second tetrachord, *hypate mese*, *parhypate mese*, *lichanos mese*, and *mese*. In the third tetrachord, *trite synemmenon*, *paranete synemmenon*, and *nete synemmenon*. In the fourth tetrachord, *paramese*, *trite diezeugmenon*,

paranete diezeugmenon, and *nete diezeugmenon*. In the fifth tetrachord, *trite hyperbolæon*, *paranete hyperbolæon*, and *nete hyperbolæon*.

Of these eighteen notes, the eight which began and ended the several tetrachords were fixed, and invariable, like our fundamental, fourth, fifth, and their octaves. The other ten, were moveable, as are our second, third, sixth, seventh, and their octaves. From the variation of these ten notes, arose the three species of music, which the ancients called *enharmonic*, *chromatic*, and *diatonic*; and the different colours (as they called them) of each of those species.

The intervals forming each tetrachord in these three species, and their respective colours, are as follows: the *enharmonic* tetrachord had but one colour; it was formed by a *diefis* (that is a quarter of a tone) then another such *diefis*, and lastly a *ditone*, (*i. e.* a double tone.)

The *chromatic* tetrachord had three colours; *molle*, *sesquiplum*, and *tonæum*; the *molle* was formed by a *triental diefis* (*i. e.* a third part of a tone) then another such *diefis*, and lastly a *trihemitone* (or tone and half.)

The *sesquiplum* rose by a *sesquialter diefis* (*i. e.* $\frac{4}{3}$ of a tone) then such another *diefis*; and lastly, a tone and three quarters.

The *tonæum*, by a *hemitone*, then another *hemitone*, and lastly a *trihemitone*, and this last is the common *chromatic*.

The *diatonic* had two colours, *molle* and *syntonum*. The *molle* rose, by a *hemitone*, three *quadrantal diefis*, and five such *diefis*.

The *syntonum* by a *hemitone*, a tone and another tone; and this last is the common *diatonic*, so that every tetrachord was composed of two tones and half, though differently distributed and divided.

In the diagram, Fig. XXXVIII, I have shewn the several intervals, or tones, in each species, with their relation to the modern intervals and notes; but, as Vitruvius makes no mention of the different colours, I have also omitted them, giving only the intervals of the common *diatonic*, *chromatic*, and *enharmonic*, the former of which are the same as now used by the moderns.

WHEN the voice is modified in variations, it is made either more shrill, or more bass, and may be moved in two manners; of which, one is continued, the other detached. The continued voice rests neither at the limits of the tones, nor at any other part, rendering the terminations imperceptible, although the middle of the intervals are very obvious; as when, in discourse, we say *sol, lux, flos, nox*; for in these neither the beginning or ends of the variations of the voice are perceptible, and it is not sensible to the ears where it changes from bass to shrill, or from shrill to bass. But in the detached it is otherwise; for here the voice, in varying, rests on the limits of some sounds, then on others, and makes frequent and sensible variations to and fro; as by the changes of the voice in singing, we make a variety in the modulation. When, therefore, these tones are changed, the points where they begin and end are made obvious by the evident distances of the sounds; whilst the others are plain in the middle only, and their limits indistinct.

THERE are three species of modulation. The first, that which the Greeks name *armonian*, the second *chroma*, and the third *diatonon*. The harmonic modulation is the product of art. This music is chiefly bass, and is much esteemed. The chromatic, being acute and brisk in its modulation, is more sweet and pleasing; but the diatonic, being natural, is more easy in the distances of its intervals.

IN these three species the tetrachords are differently divided. The harmonic tetrachords have of tones and dieses two of each. A diesis is a quarter part of a tone, so that a hemitone contains two dieses. The chromatic are composed of two hemitones in succession, and a third interval of a trihemitone. The diatonic have two successive tones, and the third is a hemitone^{2*}, which terminates the measure of the tetrachord. Thus the tetrachords in all the three species are equally constituted of two tones and a hemitone; but each kind being separately considered, every one is found to have a different disposition of the intervals. Nature then has divided the sound of the voice into the intervals of tones, hemitones, and tetrachords, and fixed their bounds, the quantity of the intervals, and the certain distances which constitute their quality. This therefore the artificers, who make instruments of music, observing and practising, as nature has established, by that means give their works the proper accordance and perfection.

TONES, which by the Greeks are called *phthongoi*, are in each species eighteen; of which eight in each species are immutable and permanent; and the remaining ten, according to the usual modulation, are moveable. The permanent are those which being disposed between the variable, preserve the connection of the tetrachords, and which, in the several species, have their limits fixed. They are thus named: *proslambanomenos*, *hypate hypaton*,

(2*) Vitruvius mentions the hemitone, as following the two tones in the diatonic tetrachord; whereas it is generally understood to be before them. See the succeeding notes.

hypate meson, mese, nete synemmenon, paramese, nete diezeugmenon, and nete hyperbolæon. The moveable are those which are disposed in the tetrachords, between the permanent, and vary their places according to the species. They have these names: parhypate hypaton, lichanos hypaton, parhypate meson, lichanos meson, trite synemmenon, paranete synemmenon, trite diezeugmenon, paranete diezeugmenon, trite hyperbolæon, and paranete hyperbolæon.

THOSE which are moveable have also other properties, for their intervals and distances are augmentable; thus, parhypate, which, in the harmonic species, is only a diesis distant from hypate, in the chromatic is increased to a hemitone, and, in the diatonic, to a tone^{3*}; also, that note which is called lichanos, in the harmonic species, is a hemitone distant from hypate, but, in the chromatic it is augmented to two hemitones, and in the diatonic to three hemitones distant from hypate. Thus these ten sounds, by means of their transitions in the different species, produce a threefold variety in the modulation.

THERE are five tetrachords: the first is the basest, which, by the Greeks, is called *hypaton*; the second is the mean, which is called *meson*; the third is the conjoined, called *synemmenon*; the fourth is the disjoined, called *diezeugmenon*; the fifth, because it is the most acute, is called by the Greeks *hyperbolaion*.

THE concords which the human voice can naturally modulate, and which, by the Greeks are called *symphoniai*, are six; diatessaron, diapente, diapasen, diapasen with diatessaron, diapente with diapasen, and disdiapasen, which receive their names from number; for the voice being first fixed on one given interval of sound, then varying when it arrives at the fourth interval from thence, it is called diatessaron; the fifth is called diapente; the eighth, diapasen;

(3*) Here we find parhypate, in the diatonic tetrachord, described to be a tone distant from hypate. This is usually explained to be but an hemitone distant; wherefore Meibonius, with Perault, and Galiani, following him, have supposed the text to be corrupted by the copyists; and that instead of *diatono vero tonum*—*diatono hemitonium* should be read; to which latter Galiani has altered the text. I have, however, chose to adhere to the usual reading; and, with some remarks thereon, thus leave it to the sense of the reader.

Vitruvius's intention is evidently to give an example of the augmentation or progression of the same note in the three different species of music; it may therefore be reasonably supposed that, if this progression had not existed in the note, he has chosen to exemplify it by, he would not have chosen it for his example; but his choice of it is a full evidence that this note had such progression in his understanding, and absolutely forbids a supposition of its being an error of the copyists; we see also that the note lichanos,

which he next instances, perfectly agrees in this proportional increase.

It cannot then be an error of the copyists; and I am inclined to believe it is no error at all; but am rather of opinion that the parhypate of the diatonic tetrachord was variable in place, being sometimes a hemitone, and sometimes a tone, distant from hypate, corresponding to our C natural and C sharp; by that means (with the other proper changes) making the key of the music sometimes flat and sometimes sharp. According to the commonly received disposition of the ancient notes, the diatonic music must have always been in the flat key; but I cannot conceive any reason why we may not suppose the sharp key to have been in use with the ancients as well as with us; for we find the voice fixes on the intervals of the sharp key rather more easily and naturally than on those of the flat.

I am, therefore, of opinion, that the text is pure, or at least doubtful; and, for that reason, Galiani ought not to have so hastily admitted an alteration.

the eighth, and half the eighth, diapason with diateffaron; the ninth, and half the ninth, diapason with diapente; and the fifteenth disdiapason: for, with the intervals of the third^{4*}, the sixth, or the seventh, either by the sound of strings, or by that of the voice, no concord can be made; but diateffaron, diapente, and the rest, in order as above written, up to disdiapason, have their intervals of sound naturally agreeable and concordant. These concords are generated by the union of sounds, which are called by the Greeks *phibongoi*.

C H A P T E R V.

Of the Vases of the Theatres.

BY means of these investigations, the brazen vases, which are used on account of the magnitude of theatres, may be made. These are so formed, that, upon being struck, they sound in themselves diateffaron, diapente, and so in order to disdiapason. After which they are disposed according to the laws of music, in cells formed within the seats of the theatres, in such a manner as not to touch the wall, and have a vacancy all round them to the top of the cell. They are situated inversely, and, on the side which is turned toward the scene, they are supported by wedges not less than half a foot high; also, opposite to these cells, in the beds of the lower seats, apertures are left, two feet long, and half a foot high.

Fig. XXXIX. THE disposition of these vases is thus explained: If the theatre is not of a great magnitude, the range of the vases is fixed at the middle of its height, and therein are formed thirteen cells, for the twelve equal distances of the intervals. Then those vases which sound nete hyperbolæon, as before written, are first placed in the cells which are at the extremity of either horn. In the second cells from either extremity is placed the diateffaron (of the former) nete diezuegmenon; in the third the diateffaron, nete parameson^{1*};

(4*) It may not be wholly useless to mention a conjecture concerning the reason why the ancients did not allow the third to be a concord. They began their first tetrachord at that note which is called by the moderns the second; viz. B. fig. XXXVIII, for they did not reckon proslambanomenos as any part of the scale, consequently our second was their first, and our fourth their third, so that their third was made by the interval between our second and fourth. Now, between the second and fourth, there is only a hemitone major and a tone minor, which makes a

defective third; for, to form a perfect natural third, a tone major and a hemitone major is required, and then it has the proportion of five to six, in which only its concordance and harmony consists; as therefore the ancient third wanted this proportion, it consequently could not harmonize, or sound concordant.

(1*) This is to be understood paramese only, that note being the diateffaron, or fourth to nete diezuegmenon, as fig. XXXVIII. shews.

in the fourth the diateffaron, nete fynemmenon^{2*}; in the fifth, the diateffaron, mese; in the sixth, the diateffaron, hypate mefon; and in the middle one, the diateffaron, hypate hypaton. By this regulation, the voice from the scene, as from a center, diverging itself around, and striking the cavities of the several vases, is made more sonorous and clear by their corresponding consonance.

BUT if the theatre is of an ample magnitude, then the height is divided into four parts, that there may be made three ranges of cells; one for the harmonic, another for the chromatic, and the third for the diatonic. The harmonic is first disposed at bottom, in the

same order as described above for the lesser theatre. In the middle range, the
Fig. XL.

vases, which have the sound of the chromatic hyperbolæon are first placed at the extremity of the horns; in the second cells, the diateffaron from this, the chromatic diezeugmenon; in the third the diateffaron, the chromatic fynemmenon; in the fourth the diateffaron, the chromatic mefon; in the fifth, the diateffaron, the chromatic hypaton; and in the sixth, the paramese^{3*}; because this last has a common accordance with the chromatic hyperbolæon, as the diapente; and with the chromatic mefon, as the diateffaron. In the middle no vase is placed, because no other tones in the chromatic species of music can be concordant.

(2*) Nete fynemmenon cannot be the fourth, or diateffaron of paramese; this, several of the translators have noticed. Meibonius and Perault have supposed it to be an error, and that diapente should be read instead of diateffaron, supposing it was meant to be the fifth, or diapente of the hyperbolæon; but Galiani has rectified their mistake, by supposing that Vitruvius speaks of it as the diateffaron of the succeeding tone (viz. mese) and not of the preceding tone, paramese; the reader will also observe, by referring to fig. XXXVIII, that the notes mentioned are the terminating notes of the several tetrachords; of which, nete fynemmenon was one.

The terminating notes of the several adjoining tetrachords were diateffarons, or fourths, to each other, except in the tetrachords, fynemmenon, and diezeugmenon, which were never used together in singing; it was nevertheless necessary to have both those tetrachords, because the melody, as well as harmony of the music, sometimes required their assistance (as I have remarked in the foregoing account of ancient music) and the actor directed his voice to the one or the other, according to the tone required.

(3*) Vitruvius, in this case, names only the tetrachords, not the particular notes; but, as he says, paramese is diapente, or fifth to hyperbolæon, and diateffaron, or fourth to mefon, we may easily discover the particular notes; for

the diateffaron to paramese must be lichanos mefon, and the diapente must be paranete hyperbolæon, not trite hyperbolæon, as Galiani has concluded; for a perfect fifth must have seven hemitone intervals; whereas between paramese and trite hyperbolæon there are but six. This being settled, the several notes will be the following: Ist, paranete hyperbolæon; IInd, paranete diezeugmenon; IIId, paranete fynemmenon (which is the same as paramese); IVth, lichanos mefon; Vth, lichanos hypaton; VIth, paramese. This is shewn by Fig. XL. and also Fig. XXXVIII, where the notes used are marked with V.

It may be observed, that as the terminating notes of each tetrachord were before named, so here the upper notes, next to the terminating notes in each tetrachord, are made use of: and between the two tetrachords, fynemmenon and diezeugmenon, there is only a tone difference, as in the former case; although they are mentioned as diateffarons to one another, which has been accounted for in the foregoing note. In the following diatonic range also, the tetrachords only are mentioned; we, however, discover by the same means the particular notes; which prove to be the upper notes of the several tetrachords, as in the foregoing case; and they are in the same order, excepting that proslambanomenos is used in the place of paramese, and mese is placed in the middle cell, which is entirely vacant in the former range.

Fig. XLI. IN the upper division, or range of cells, the vases formed to sound the diatonic hyperbolæon, are placed in the first cells at the horns; in the second cells, the diateffaron, the diatonic diezeugmenon; in the third, the diateffaron, the diatonic synemmenon; in the fourth, the diateffaron, the diatonic meson; in the fifth, the diateffaron, the diatonic hypaton; in the sixth, the diateffaron, the proslambanomenos; and in the middle, the mese, because this last has a common concordance with the proslambanomenos, as the diapason; and with the diatonic hypaton, as the diapente. But whosoever desires more perfectly to understand this subject, may attend to the diagram at the end of the book, formed according to the principles of music, and which was left by Aristoxenus, who, with great ingenuity and industry, established the proportional intervals of the tones. Those therefore who study these principles, the nature of sounds, and the cause of their pleasing effects on the hearers, will be more capable of erecting theatres with due perfection.

SOME may alledge, that many theatres are built in Rome every year, without any of these contrivances being used therein; but the reason is this: all the public wooden theatres have many boarded surfaces, which are necessarily sonorous. This is made evident by the fingers, who, when they would raise a strong tone, turn themselves to the doors of the scene, and by their resonance receive a help to their voice. But when the theatres are constructed of solid substances, that is, of stone or marble, then the methods here explained become of use. If it is demanded in what theatres they are made use of, Rome cannot shew any; but the provinces of Italy, and many cities of Greece, can shew them. We know also that Lucius Mummius, who destroyed the theatre of Corinth, brought to Rome the vases of brass, and dedicated the spoils in the temple of Luna. Likewise, many ingenious architects, who construct theatres in small towns, to save expence, make use of earthen vessels to help the sound, which, being adjusted according to these rules, answer the intended purpose.

C H A P T E R VI.

Of the Form of Theatres.

Fig. XXXVI. **T**HE form of theatres is thus regulated. The central point being fixed in the middle (A,) a circle (B H) is drawn as large as the circumference of the bottom^{1*} is intended; and therein, four triangles of equal sides and intervals, are

(1*) Vitruvius does not say whether he means the bottom of the external or of the internal part of the theatre; but the circumstances of the description, and his making no mention

of the outward construction of the theatre, make it most probable that he means the bottom of the internal part, or orchestra, B H, B H.

described^{2*}; whose extremities touch the furrounding line of the circle: this, by the analogy of astronomy to music, is also the method used in the description of the twelve celestial constellations.

Of these triangles, that whose side (D D) is toward the scene, at the part where it intersects the curve of the circle, there determines the front of the scene^{3*}, and a line (H H) being drawn through the center (A) parallel thereto, separates the pulpit^{4*} (E) of the proscene from the orchestra (F;) so that the pulpit becomes broader than that of the Greeks; for, (in the Roman theatres) all the performers act on the scene (or stage) and the orchestra is assigned for the seats of the senators^{5*}. The height of the pulpit is no more than five feet, that those who sit in the orchestra may see the performance of all that is represented.

The cunei^{6*} (K) of the spectatory of the theatre, are so disposed, that the points of the triangles, which touch the circumference of the circle, determine the places of the ascents and steps (G) between the cunei, up to the first precinction (b); and above that, by the alternacy of the ascents, they also indicate the middle of the upper cunei (L). The angles, which direct the place of the lower steps, are in number seven; the remaining five determine the disposition of the scene. Opposite to the middle one (B) should be the regal doors (N); those which are on the right and left (C) fix the disposition of the hospitalian doors^{7*}; and the extreme two regard the entrances of the returns (I).

(2*) This divides the circle into twelve points, by which the disposition of the steps and passages are governed. The theatre of Marcellus appears to have been disposed by sixteen points; and the senators passages, Z Z, which led into the orchestra, were placed opposite to each point, excepting that they were all shifted out of that situation, half the breadth of a passage, from the horns, H, towards the middle, B, in order to gain a passage at the horns, within the limits of the semi-circle.

(3*) This determines the place of the front of the scene to be a quarter of the diameter of the orchestra distant from the said orchestra.

(4*) The pulpit was the stage. The proscene was the space before the scene, between that and the orchestra, and on which the pulpit or stage was raised.

(5*) Upon comparing the figures XXXVI and XXXVII, it will be seen how much the pulpit or stage of the Roman theatres was broader than that of the Greeks; for it was the custom of the Greeks to have their dancers, &c. perform in the orchestra, and the pulpit was reserved for the action of the drama only; whereas, with the Romans, the whole was performed on the pulpit, and the orchestra was occupied by the seats of the senators.

From the orchestra to the first precinction (b) was generally made fourteen rows of seats, which were allotted for the equestrian order, tribunes, &c. all above that were the seats of the plebeians; and the women were, by Augustus, appointed to sit in the gallery or portico (k) above.

(6*) The seats of the theatres were divided at regular distances by the steps, G M, in radial lines, so that the several collections of seats were in the form of wedges, broader at the top than at bottom; from whence they were called cunei, or wedges. Maffei, in his treatise of amphitheatres, asserts that the steps were not directed in radial lines, but in diagonals, making the base line of the wedge alternately at top and bottom; but as that oblique direction must be inconvenient, and as there is no particular reason for supposing such an inconvenient disposition, the former opinion is rather to be preferred.

The spectatory is that part of the theatre where the spectators sat.

(7*) The scene was built in imitation of the fronts of the Greek houses, in which the masters apartments were disposed in the middle, and the apartments on either side were allotted for the reception of strangers; hence the doors on the right and left of the middle one were called the hospitalian doors.

THE degrees (a) of the spectatory, whereon the seats are laid, should be in height not less than a foot and a palm, nor more than a foot and six digits; their breadth should not be more than two feet and an half, nor less than two feet.

C H A P T E R VII.

Of the Porticus and other Parts of the Theatre.

THE roof (m) of the porticus (k) which is on the highest degree, is to be level with the top of the scene; for the voice ascending regularly to the uppermost degrees and roof, will, if the top is not all on a level, be lost at the summit of that part whose altitude is least, and to which it first arrives.

WHATEVER may be the diameter (H H) of the orchestra, which is encompassed

(8*) We learn from passages in sundry authors, that the ancients used to lay coverings of wood, or cushions, &c. on the stone seats of the theatres; and these words of Vitruvius, *Gradus spectaculorum ubi subfellæ componantur* (the degrees where the subfells or seats are laid) seem to intimate the same; the word *subfellæ* signifies some kind of seats, and cannot mean the degrees, or stone seats themselves, because it is said they are laid on the degrees; it is therefore probable that by that word Vitruvius means the coverings of boards, cushions, &c. which were laid on the stone degrees. Perault remarks, that Dion Cassius had overlooked this passage of Vitruvius, when he asserted that such coverings were not laid on the degrees of theatres, before the time of Caligula; adding, that, as Vitruvius wrote in the time of Augustus, they must have been used in his time; but this is taking it for granted, that Vitruvius wrote in the time of Augustus; that not being certain, these words of Dion Cassius become an argument in favour of the opinion that Vitruvius did not write at that time, nor till after the time of Caligula, in whose reign Dion Cassius wrote. See the Remarks on the Life of Vitruvius.

(9*) A palm is a quarter of a foot: it has before been observed that the ancient Roman foot was 11 inches $\frac{1}{4}$ of our foot, and was divided into sixteen digits; the height therefore of the degrees was not less than about a foot and a quarter, nor more than a foot and three eighths. In the theatre of Marcellus, the degrees were in height half their breadth; which proportion I have chosen to follow in my draught, fig. XXXVI, making the degrees one foot and a quarter high, and two feet and a half broad.

(1*) Vitruvius gives us no directions concerning the proportion of the orchestra to the whole building, that depend-

ing on the number of degrees disposed around the orchestra, which might be determinate; it must, however, be supposed that so great a number were not disposed around small orchestras as around larger, and that some bounds were observed. The orchestra of the theatre of Pola, given by Serlio, and which subsisted at the time he measured it, was, in diameter, one third of that of the whole building; and, in a theatre represented in the fragments of the plan of Rome, now preserved in the Capitol, the diameter of the orchestra is nearly of the same proportion.

In the theatre of Marcellus, it was as four is to eleven, or thereabout. Barbaro, Perault, and Galiani, following each other, have, in their draughts, made it nearly as one to two, which is more than it is found in any ancient theatre, and is productive of many inconsistencies, as will be hereafter shewn. I have chosen the proportion of that of the theatre of Marcellus. Perault, and Galiani, would persuade us that Vitruvius means the *semi-diameter* of the orchestra, where he mentions the *diameter*; because the sixth part of the diameter, which he gives to the height of the entrances (as they understand the word *itenerum*) into the orchestra, is, in their opinion, too great. But, notwithstanding the reasoning of Perault, I cannot so easily assent to a deviation from the express words of the text. It may as well be supposed that Vitruvius means *semi-diameter*, where he writes *diameter* in the description of the round temples, and in all other parts of his work. Perault, with an intent to prove that Vitruvius means the *semi-diameter*, and not the *diameter*, brings, as an argument, a passage from Pliny, who says, *that the theatre of M. Scaurus was one of the largest ever built, and that the lower columns of the scene of this theatre was 42 feet high*. Vitruvius, in the next paragraph, says, *such lower columns should be in height the fourth part of the diameter of the orchestra; according to this rule, therefore, the diameter*

by the lowest degree, the sixth part thereof is taken; and at the horns (H) and around the passage, with this measure (i p) set perpendicular, the lower seats are marked; and where

of the orchestra of the said theatre must have been 168 feet. The orchestra of the theatre of Marcellus was 180 feet French. Perault then argues, that, at this rate, the theatre of Scaurus was less than that of Marcellus; whereas Pliny says, that of Scaurus was one of the largest ever built; but, continues he, if it is admitted that Vitruvius means semi-diameter, then the orchestra of Scaurus must have been in diameter eight times the height of those columns, that is 236 feet; 56 feet larger than that of Marcellus; and thus it will better agree with the words of Pliny.

In this calculation, Perault has made a mistake of 100 feet; for 8 times 42 is 336, instead of 236, as he writes; consequently the diameter of the orchestra of Scaurus was 156 feet larger than that of Marcellus; an enormous width greater than any of the few remains of theatres that have reached us will authorize, and even exceeding the internal area of the Coliseo in its longest diameter (which is but 218 $\frac{1}{2}$ feet, Veronese). The theatre of Pola, measured by Serlio, was one hundred and thirty feet, and another near Viterbo, one hundred and forty one feet and an half.

But the words of Pliny will not authorize such a construction as Perault gives them. Pliny says the theatre of Scaurus was one of the largest ever built; from whence it does not follow that it was larger than the theatre of Marcellus; which also was one of the largest ever built, and may have been larger than that of Scaurus, without contradicting the words of Pliny.

Supposing then, of these two large theatres, that of Scaurus to have been the smaller, the words of Vitruvius (allowing him to mean what he says) will be found to agree, and the orchestra of Scaurus, according to this rule, must have been 168 feet, which is but 12 feet (or a fifteenth part) less than that of Marcellus; a measure more probable, and approaching nearer to the dimensions of other ancient theatres.

Thus the argument of Perault turns against himself, and greatly contributes to prove that Vitruvius means the full diameter (as he writes), and not the semi-diameter of the orchestra.

(2*) This path or passage, around which the lower seats are said to be marked, must undoubtedly be a passage round the back, or semi-circular part of the orchestra, H B O; for no other place can be easily imagined about which the lower seats may be marked; and such a passage must have been very necessary, and almost indispensable, in order to give free access to the several seats in the orchestra.

(3*) These lower seats which are marked, must consequently be as high as the measure by which they are marked. But whether by the words *inferiores sedes*, the lower seats, we are to understand two, three, or more of the lower de-

grees, or the lowest degree only, as containing the lower order of seats, is a doubt: Perault and Galiani have understood it in the former sense, because they think the lowest degree would, in the latter case, be too much elevated above the floor of the orchestra.

But, wherever Vitruvius means the degrees, he uses the word *gradi*; whereas he here uses the word *sedes*; from whence it may be supposed that he expresses by that word the several single seats contained in one degree. Also, as he directs these seats to be marked around the passage at the back of the orchestra, which adjoins to the lowest degree, it is most natural and rational to suppose, that it is that lowest degree which he means to be marked, and not the degrees above, which are at a considerable distance from that passage, and which could not be easily reached from thence.

The only foundation for the opinion of Perault and Galiani (who imagine that, by this mark, the height of the senators entrances are determined) is their own opinion, that, if the height of the lowest degree was to be understood to be determined thereby, that such degree would be too much elevated. But, as we know not the exact formation of the ancient theatres in this respect, or the necessity there might have been for this great elevation, such opinion is not to be held in competition with the probabilities on the other side the question, arising from the words of the text: it is very probable, nay even necessary, that the floor of the orchestra (i i) should have been raised as it receded from the stage, that those who sat behind might see over the heads of those who sat before; the more it was raised the more convenient it would have been in this respect. The degrees were inclined in an angle of 22 $\frac{1}{2}$; and if the floor of the orchestra had been raised to a third of that inclination (*i. e.* in an angle of 7 $\frac{1}{2}$) it would not have been more than convenience required. In such case, the lowest degree, supposing it to have the fore-mentioned elevation, would have been but the twelfth part of the diameter of the orchestra above the highest part of the floor of the orchestra, which would have been no more than sufficient to prevent the populace in the degrees from forcing into the orchestra among the senators. For these reasons, therefore, the lowest degree ought to have been considerably elevated; and that elevation should have been always proportional to, and dependant on, the diameter of the orchestra, that the situation of the spectators might have been properly adapted to their distance from the stage; but the height of the entrances is no ways connected, or related to the diameter of the orchestra, and is of no consequence to the conveniences or appearance of the theatre. I am therefore of opinion that it is the lowest degree which Vitruvius means should be raised above the orchestra the sixth part of its diameter.

the mark happens, there the supercilia^{4*} of the passages are made; for thus they will have a sufficient elevation.

THE length (I I) of the scene should be made double the diameter of the orchestra^{5*}. The height of the podium (r) from the level of the pulpit, is the twelfth part of the diameter of

Perault objects, that, by such an elevation of the lowest degree, the dancers who performed in the orchestra of the Greek theatres would have been in a great measure unseen; but Vitruvius does not here treat of the Greek theatres; he is speaking of the Roman. Vitruvius says, *the Greek theatres are in many respects different*; and, though he does not mention this circumstance as one of the differences, yet they must certainly have been different in this part; for, as the senators sat in the Roman orchestra, it must have been in some degree inclined (as before said); but the Greek orchestra, being for the use of the dancers, it must have been level; therefore, there not being the same reasons for so great an elevation of the lowest degree in Greek theatres, it was probably situated no higher from the level floor of their orchestra than it was from the highest part of the inclined orchestra in the Roman theatres.

(4*) Where the mark happens, there the supercilia of the passages are made *qua præciso fuerit, ibi constituentur itinerum supercilia*.

The supercilia is, as has been explained at the third chapter of the third book, any cornice, or superior moulding: it is here directed to be placed where the mark happens at the lower seats; which has been argued to mean the lowest degree; and which, therefore, must be the place where the supercilia, p p, is to be placed.

But Vitruvius calls it the supercilia of the *passages*, mentioning *passages (itinerum)* in the plural. By its place it seems to be the supercilia, or cornice of the *passage* that goes round the back of the orchestra; and therefore it seems that the word *passage*, or *path*, should have been mentioned in the singular; but it is not unusual with Vitruvius to mention in the plural many words that appears to us to belong to the singular number; and the contrary (thus he mentions the architrave, or epistylum over a range of columns, in the plural, calling it the architraves, or epistylums); so, if this passage round the orchestra was used to be divided into parts, by temporary partitions here and there between each entrance, &c. it would have been sufficient to cause Vitruvius to speak of it in the plural. This being mentioned in the plural, has caused Perault and Galiani to imagine, that by the word *itinerum* is meant the entrances or doors, z z, that lead into the orchestra; but firstly, Vitruvius does not use that word to signify any kind of aperture, but for a passage or pathway, as in the third chapter foregoing, he uses it for the passage way of the precincts (*itineris precinctiois*.) Secondly, He gives no description of those doors or entrances, nor of any of the internal parts of the fabric; but describes

only the disposition of the spectator and scene of the theatre. Thirdly, There appears no reason that such doors of entrance should be governed, in their height, by the diameter of the orchestra, and vary as that varies (they being rather to be numbered among the parts hereafter mentioned, whose measure should be the same in all theatres, whether large or small, as respecting the natural magnitude of the human body, and cannot effect the prospect of the theatre whether greater or less. Fourthly, Vitruvius positively mentions the passages (by the same term, *itineræ*) among those things that are invariable in their dimensions in all theatres, and therefore cannot here mean that the same *itineræ*, or passages, are to be governed in their dimensions by the different magnitude of the orchestra. Fifthly, That the width of such doors is as necessary to be adjusted as their height; and, as the former is not mentioned, it may well be concluded that neither is the latter. Sixthly, The height of the passage round the orchestra (by which also the height of the lowest degree is determined) is necessarily dependent on the magnitude of the same orchestra, in order that the height of the spectators may be adapted to the distance of the stage, as before urged: from all these arguments, therefore, it appears much more probable that it is the same passage round the orchestra here meant by the word *itinerum* that was before signified by the word *aditus*, and that the supercilia mentioned is the cornice of that passage. Vitruvius adds, *for thus they will have a sufficient elevation*; the word *THEY* must be understood to allude the lower seats, not to the passages, notwithstanding the order of the words may seem to point to the latter; for the foregoing notes shew that it is the lowest degree, whose height is thus regulated by the magnitude of the orchestra; and not the passages, which were no ways dependant on the measure of the orchestra.

(5*) Vitruvius says, *the length of the scene should be double the diameter of the orchestra*.

It has been before argued that Vitruvius uses the word diameter in its proper sense; there can, therefore, be no doubt of the meaning of this sentence. Perault and Galiani, who have before understood diameter for semi-diameter, and have also made the diameter of their orchestra equal to half the diameter of the whole fabric, are in some difficulty to reconcile their opinions with the authority of the antique; and to get extricated from a web, in which they have entangled themselves, they have each chosen a different method. Perault, finding that the vestiges of ancient theatres prove that the scene was ever longer than the diameter of the or-

the orchestra, including (in that height) the corona and lyfis^{6*}; upon the podium columns (s) are raised, which, with their capitals and bases, are equal in height to the fourth part of the said diameter. The entablature (t) is the fifth part of the height of the columns. The pluteum (u) above, with its base and coronæ, is the half of the inferior pluteum^{7*}. Above this pluteum, are other columns (v), a fourth part less in height than those below; their entablature is the fifth part of the columns. Also, if there is to be a third order, the upper pluteum is to be the half of the middle one, and the upper columns a fourth part less in height than those of the middle order; the entablature likewise is to be the fifth part of the height of the columns.

HOWEVER, in all theatres, the same proportions and symmetry may not be suitable. An architect should therefore consider what symmetry is proper to be used, and what proportions the nature of the place, or magnitude of the work, may require; for there are some things that, both in small and in large theatres, must, on account of convenience, be made of the same magnitude; such are the degrees, the diazomatæ^{8*}, plutei^{9*}, passages, stairs, pulpit, and tribunal^{10*}; and if other things occur, that interfere with the symmetry, convenience must

chestra, and that his former acceptance of diameter for semi-diameter, would make his scene no longer than the diameter of the orchestra: and also, that if he made the scene double the diameter of the orchestra, it would equal or even exceed the diameter of his whole building; has chosen to alter the text from *duplex* to *triplex*; and by that means he makes the length of his scene, once and half the diameter of the orchestra, or three semi-diameters. Galiani has made his scene no longer than the diameter of the orchestra, which is contrary to the authority of the antique; and is, besides, very inconvenient to the theatre; for the high walls of the returns of the scene, in his theatre, would obstruct the sight of the spectators; so that those that sat near either horn could not see the scene, or the revolving machines, but the edge of the stage only. The scene of the theatre at Pola, which was standing, when measured by Serlio, was considerably longer than the diameter of the orchestra; so also was that of the theatre of Marcellus, as the remains of a pier and column still subsisting demonstrate, as well as the draught of that theatre represented in the fragments of the plan of ancient Rome.

In the same fragments, there is also the representation of another theatre, supposed to be that of Pompey, in which the length of the scene is likewise nearly double the diameter of the orchestra.

These examples of antiquity, therefore, tend to confirm the foregoing arguments; and upon the whole it appears that we must adhere in this case also to the express words of Vitruvius, and make the scene double the diameter of the orchestra, as he prescribes. On one side of the scene, I have represented a vestibule, y, such as the remains shew to have adjoined to the scene of the theatre of Marcellus.

(6*) Lyfis. See note 5*, chap. III. book III.

(7*) The *pluteum* and *podium* are the same, and signify what we call the *dado*. Philander has supposed the pluteum to be the entablature between a lower and higher order of columns; but the place here assigned them fully evinces the contrary. See note 3*, chap. I. book V.

(8*) Diazomatæ is the Greek name of the precipitions:

(9*) The plutei of the scene have been before said to be always proportional to the diameter of the orchestra; these, which are said to be always of the same dimensions in all theatres, whether large or small, must be situated in some parts of the spectatory, to serve as fences to the spectators, like our modern ballustrades.

Their situation was probably at each precipition, and at the lowest degree of the theatre, to secure the people from falling at those precipices. I also suppose the degrees at either horn were terminated by such plutei, in an inclination parallel to that of the degrees, and running up from the lowest degree till they met the return walls of the scene.

(10*) The tribunal may be the place that was assigned for the seats of the prætors, or other magistrates, who presided at the shews; for that the magistrates attended, and had particular places appointed for them, we may learn from Suetonius, who tells us, that Augustus ordered that the vestals should sit at the podium, opposite to the prætor.

not be neglected. Likewise, if the materials, such as marble, timber, and other things, which are used in buildings, should be scarce, the work must be a little reduced or enlarged, till it properly agrees with the intention. This will be duly observed, if the architect is experienced, and is not deficient in ingenuity and judgment.

THE scene is to be so contrived as to have doors (N) in the middle, with regal decorations: to the right and left the hospitalian doors (P), and near ^{11*} by the places allotted for the scenery. These places the Greeks call *periactous*, because therein are the revolving machines (R), ^{12*} having three sides, and on each side a different kind of representation, which, when there are any changes of the fable, or on the arrival of Gods with thunder, are suddenly turned, and change the kind of representation in front. Near this place are the ingresses (I) of the returns; one supposed to lead from the forum, and the other from the country.

C H A P T E R VIII.

Of the three Kinds of Scenes, and of the Theatres of the Greeks.

THERE are three kinds of scenes; one is called tragic, another comic, and the third satyric. These are different and dissimilar to each other. The tragic is composed of

(11*) Perault has translated *secundum* (which Vitruvius always uses for *near*, or *adjoining*, &c.) *deriere*, or *behind*, so making it to be understood that the revolving machines were placed behind the aperture of the doors, which would infallibly prevent the entrance of the actors, and render the doors useless; at least those machines must be turned every time an actor is to crowd past them.

Vitruvius says they are near the hospitalian doors; and the order he observes in describing the parts of the scene, gives us to understand, that they are on that side the hospitalian doors which is next the returns of the scene.

Galiani has disposed them on either side the orchestra, in a line reaching from the horns thereof to the scene, in the manner of our side-scenes. This disposition may suit very well with the theatre of Galiani, who makes the length of the scene to be no more than the diameter of the orchestra; but, as it has been sufficiently proved that the scene ought to be in length double the diameter of the orchestra (by which length, the view from the spectatory is enlarged, and the stage better seen by the greater part of the spectators) that disposition is very unfuitable for theatres so formed,

as it hides the remaining length of the scene entirely, and obstructs the view of the center of the stage, the regal and hospitalian doors, as well as those of the returns from the spectators who sit near, or even at some distance from, the horns of the theatre.

As the order Vitruvius observes in describing the scene, is from the middle to the extremes, on the right and left, mentioning all the parts on the face of the scene in their order, in his way; and, as he mentions the said revolving machines between the hospitalian doors and the entrances of the returns; it appears to me that their situation was most likely on the face of the scene, between the said entrances; as see R R, Fig. XXXVI.

(12*) We know little of the nature of these machines more than what we may learn from this passage of Vitruvius; the ancients had other kinds of scenes, which were drawn before each other, like our modern scenes, and to which they gave the title of *ductilis*, as these that turned upon an axis were called *versatilis*.

columns, fastigiums, statues, and other majestic objects. The comic has the appearances of private edifices, balconies, and windows, disposed in imitation of the manner of common buildings. But the satyric is adorned with trees, vallies, mountains, and other rural objects, represented in topiarian work.

Fig. XXXVII. IN the theatres of the Greeks the same methods entirely are not pursued; for, first, in the circumference (B H H) at bottom, where, in the Latin theatres, four triangles are formed, in these there are three squares, the angles of which touch the circumferent line; and that square whose side (D D) is next to the scene, and intersects the curve of the circle, at that place determines the end of the proscene; and from that point, at the extreme circumference (B) of the circle, a parallel line (P P) is drawn, on which the front of the scene is erected. Also, through the centre (A) of the orchestra, a line (H H) parallel to the line of the proscene (D D) is described; and where it intersects the circular lines to the right and left, in the horns of the semicircle, centers (H H) are formed; and the compasses being fixed in the right horn (H), from the left interval (H), a circular line (H E) is drawn to the right side (E) of the proscene; likewise the central foot being placed in the left horn (H), a circular line (H F) is drawn from the right interval (H) to the left side (F) of the proscene. By this description with three centers (H A H) the orchestra, and the recess of the scene, in the Greek theatres, become larger; and the breadth (D P) of the pulpit, which they call *logeion*, is smaller; because, with them, the tragic and comic actors perform on the scene, and the other performers act in the orchestra. Hence the Greeks

(1*) The planning and planting of gardens, grounds, &c.

(2*) I am of Galiani's opinion, that the right side of the spectator must be understood to be the left side of the proscene; and the contrary; otherwise it is impossible to reconcile the circumstances of the description.

The preceding translators, who have supposed the right side of the spectator to be also the right side of the proscene, have not been able to understand the description themselves; and the lines they draw, in attempting to explain it, are without use or meaning.

(3*) I am also of opinion, that not only the orchestra was by these centers, H H, continued from the horns of the semi-circle to the proscene, but that all the degrees around the orchestra were also continued by the same centers to the proscene, as I have shewn in my draught, Fig. XXXVII.

I can imagine no objection to this enlargement of the theatre; the words of the text do not oppose it; nor do they imply that the degrees must terminate at the horns of the semi-circle. In the Roman theatre, they terminated at that place; but, in the Roman theatre, the proscene began there; and, as the degrees terminated against the line of the pro-

scene, in the Roman theatre, it is some reason for supposing they should do the same in the Greek theatre. The degrees surrounded the whole orchestra in the former, why not therefore in the latter: it appears absurd to make the orchestra extend forward to the front of the proscene, unattended by the degrees, as Galiani has represented it. To what purpose is the space between the horns and the proscene applied? And how is it to be disposed of? Besides, Vitruvius, in the foregoing chapter, describes the orchestra to be encompassed by the lowest degree; we cannot suppose he means a part of the orchestra; his words imply the whole circumference, from proscene to proscene.

Galiani has not only made the degrees terminate at the horns, H, but has also inclosed them with a high wall, reaching to the top of the theatre; by which means, those who sat near the horns could not see the whole orchestra; nor, indeed, much farther than the center, A; a great number would be prevented from seeing the front of the stage, and a still greater number could never see the hospitialian doors, or scenery. Instead of a high wall, a pluteum or ballustrade running up the degrees, at their termination against the proscene, would have been a sufficient fence, and not have obstructed the sight of the spectators.

distinguish them by the names of *scenici* and *thymelici*. The height of this *logeum* should not be less than ten feet, nor more than twelve. The steps (C) between the *cunei* (K), and seats up to the first *precinctio* (b), are disposed opposite to the angles of the squares. From that *precinctio* to the second, they are directed in the middle between the former, and so on to the top, making as many changes as there are *precinctio*s, and always enlarging.

WHEN all these things are carefully and judiciously adjusted, then great care must also be taken, that the situation chosen be such, that the voice may exert itself with facility, and not recoil, or convey the significations to the audience indistinctly; for there are some places naturally obstructive of the motion of the voice; as the *dissonant*, which the Greeks call *catechontes*; the *circumsonant*, which are called *periecontes*; and the *resonant*, called *antechontes*; but the *consonant* they name *synechontes*.

THE *dissonant* are those where the first sound having ascended upward, is repelled by some superior solid body, and recoiling downward, counteracts the ascent of the ensuing sounds; the *circumsonant* are such where the excited voice revolving round, settles itself in the middle, without founding the terminations, and is there lost, leaving the significations of the words uncertain; the *resonant* are such wherein the sound, meeting with some strong repercussion, reverberates, and causes the terminations to be heard double; but the *consonant* are those wherein the ascending sound, being strengthened from below, the words are clearly and distinctly conveyed to the audience.

THUS, if in the choice of the situation due care is taken, the effect of the voice, and the utility of the theatre, will be improved. Concerning their forms, which are different to each other, it is to be observed, that those which are designed from squares, are used by the Greeks; and those from equilateral triangles, by the Latins. By these instructions theatres may be erected with due perfection and propriety.^{4*}

(4*) After this description of ancient theatres, it may not be improper to make some reflections concerning their application to modern use, and how far their mode of construction may be conveniently imitated in modern theatres.

The ancient stage was limited by the fixed scene to a very small proportional depth, or extent from the front; and the whole action was performed near the front of the stage.

The place of action, therefore, being confined to one spot, the spectators might very properly and conveniently be disposed around it, in the form of a semi-circle.

But the machinery, changes of the scene, and other representations which have been introduced in our modern theatres, require a great extent of stage. The place of action in modern theatres being, therefore, variable to all distances, from the front of the stage, the spectators cannot be con-

veniently situated round any certain point, so as to have their sight always directed to the place of action; but, to have a perfect view of the whole stage at all distances, the seats must be disposed in lines parallel to the front thereof, terminated at either end by a line at right angles, drawn from either side of the stage; or at least the lines of the seats should never exceed such a portion of a curve as may be formed by a center, at the utmost distance of the stage, and terminated on the sides by radial lines drawn from the same point, intersecting the front of the stage at either end; for, by this disposition, every part of the stage will be exposed to the view of every spectator.

But as one part of the entertainment of our theatres consists in the sight of the company, to which the semicircular disposition of the seats is best adapted, it may be allowable to

C H A P T E R IX.

Of the Porticos behind the Scenes, and of Ambulatories.

BEHIND the scenes, porticos are erected, for the people to retire to, in case sudden rains should interrupt the shews; and also to allow room for the managers to prepare the chorus. Such are the Pompeian portico, the portico of Eumenices, and of the temple of Bacchus at Athens; also the odeum, which is on the left hand, in returning from the theatre, and which Pericles raised at Athens with stone columns, and crowned with the wrecks and antennæ of the vessels taken from the Persians; this was burnt in the Mithridatic war, and restored by king Ariobarzanes. There is likewise the strategium of Smyrna, and the portico of Tralles, on both sides, like the scene upon the stadium; and so in many other cities where they have had judicious architects, porticos and ambulatories are seen adjoining to the theatre. These (porticos) should be double, and have outwardly Doric columns, with the epistylum and entablature according to the modular proportions of the perfect Doric. Their breadth

prefer a disposition that, though not so perfectly adapted to one, may partake of a moderate and equal share of both.

The disposition that, I conceive, would answer this intention is that I have shewn in the figures XLII. XLIII. and XLIV. where the front line of seats is a semicircle, whose center is in the front of the stage, as in the Roman theatre, and the seats behind are turned by the same center, but extend no farther round than to lines drawn from either horn of the semicircle, at right angles with the front of the stage. By this means the lines of the degrees becoming, as they recede, portions of larger circles, approach more to a straight line, so that the nobles and persons of fortune, who sit in the boxes in the semicircle, will be best disposed for the sight of each other, while the populace in the galleries will be better situated for the sight of the performances; each however partaking of a sufficient share of the convenience of the other disposition.

The semicircle, I also imagine, gives a proper distance to the spectator from the stage, and a moderate size to the orchestra or pit, which should be no larger than is necessary to give a just distance to the front of the spectator.

The degrees, or seats of the galleries, may be disposed in the same manner as in the ancient theatres, rising as they recede: all the other parts are sufficiently explained by the draught.

The middle passage, A, leads to the semi-circle of boxes, B, the stairs, C, lead to the upper row of boxes, the royal apart-

ment, E, in the middle, takes the height of both rows of boxes; the stair-cases, F, at either end, lead to the galleries. After mounting the first and second ascent, F and G, the people return, by a passage over the first ascent, F, into the passage, H, from whence they enter by the door, I, into the precinct of the first gallery, K.

To go to the second gallery, L, they mount the third ascent, marked M, in the elevation, and which is over the second ascent, C, and then turn again into another passage, which is over the former passage, H, from whence they enter by the door, N, into the second gallery.

To go to the gallery, O, within the portico, at the top of the theatre, they ascend the stairs, P, which brings them to the hinder part of the portico.

Seats on the stage should never be permitted; and seats on the flanks of the theatre are very inconvenient; but, if they should be required, they may be made between the columns, R, over the passage, H; a small stair-case, Q, being made at the end of the said passage, to lead to them from the level of the first story; or otherwise the spaces between the said columns may be adorned with paintings of dramatic subjects, &c.

A smaller theatre might be built on the same plan, by wholly omitting the second gallery, L, and bringing the portico, O, down to the end of the first gallery, as is shewn by the figures XLV and XLVI.

should be so determined, that whatever may be the height of the exterior columns (W), so much should be the breadth from the outside of the columns at the bottom, to the middle (x); and from the middle, to the walls (C), which inclose the portico walks: the middle columns (x) are to be a fifth part higher than the exterior, and are either of the Ionic or Corinthian kind.

BUT the proportions and symmetry of these columns are not to be the same as prescribed for sacred edifices; for, in the temples of the Gods, there should be an appearance of gravity; but, in porticos, and such other works, of gaiety.^{*} If the columns therefore are of the Doric kind, their height, including the capital, is divided into fifteen parts, one of which makes the module, by which module the proportions of the whole work is to be regulated. The thickness of the column at bottom is two modules, the intercolumns five and a half; the height of the columns, without the capitals, fourteen modules; the height of the capitals one module, and their breadth two and a sixth. The modulation of the other parts is the same as is written in the fourth book for sacred edifices.

BUT if Ionic columns are used, the shaft, exclusive of the base and capital, is divided into eight parts and a half, of which one is given to the thickness of the column. The base, including the plinth, is made half the thickness of the column, and the capitals are formed in the manner described in the third book.

If they are Corinthian, the shaft and base is to be the same as in the Ionic, but the capital is made according to the rules written in the third book. Also the adjection, which is made in the stylobatæ, for the unequal scamilli, is taken from the description written in the third book; and the epistylum, cornice, and all the other parts relative to the columns, are explained in the before written books.

Fig. XXXVII. THE middle spaces (M), within the porticos, which are uncovered, are to be planted; for the hypæthral walks are exceedingly beneficial, and chiefly to the eyes; because the air from the green plants, which is subtilized and attenuated by the motion of those bodies, entering therein, clears the view, and, drawing from the eyes the gross humours, leaves the sight pure and acute; besides, when the body, by the exercise of walking, grows warm, the air extracting the humours, diminishes corpulency, and thins and dissipates whatever is superfluous in the body. This is known by considering, that in covered places, where there are fountains of water, or the earth underneath abounds with springs, no cloudy vapours arise; but in open and uncovered places, as soon as the rays of the rising sun

(1*) This is one, amongst several passages in Vitruvius, which authorize a variation in the proportions of the orders, according to the purpose and destination of the work. There are, without doubt, some limits which should not be ex-

ceeded; these, Nature and Reason must determine: but it cannot be necessary, nay it must even be erroneous, to adhere in all cases indiscriminately, to any certain measures or proportions. See the preface.

strike the earth, they excite abundant vapours from the humid soil, conglobing and exhaling them upward. If therefore it is found that, in uncovered places, the air extracts the hurtful humours from the body, in the same manner as clouds are drawn from the earth, I think it cannot be doubted that the ambulatories in cities should be spacious, agreeably planted, and be also open and uncovered.

But in order that they may be always dry and clean, they should be made thus: They must be dug and emptied a proper depth; on the right and left drains are made, and in the walls which are toward the ambulatory, pipes are inserted, inclining into the covering of the drains; this done, the place is to be filled with coal, and upon that the gravel for the walks is to be strewed and levelled. Thus, by the natural suction of the coal, and the pipes infixed in the drains, the water is drawn off, and the walks will always remain dry and without moisture.

In these buildings the ancients also made repositories for the necessaries of the city; for in sieges, all things are more easily obtained than fuel; salt may be easily imported beforehand; corn, publicly or privately, may be soon collected, and, if it fails, flesh, herbs, or pulse may be substituted in its stead; water may be obtained from wells, and, in sudden rains, received from the roofs; but fuel, which is absolutely necessary for the preparation of foods, is with difficulty and trouble provided; for it is slowly collected, and quickly consumed. In such times therefore these ambulatories were opened, and a space allotted to each tribe. Thus these uncovered ambulatories answer two excellent purposes; the one, health in peace; the other, preservation in war. By these rules, therefore, not only the ambulatories behind the scenes of theatres, but also those which, for the convenience of great cities, are erected to all the temples of the Gods, may be constructed. Having now sufficiently explained these things, an account of the disposition of baths follows next.

C H A P T E R X.

Of the Disposition and Parts of Baths.

FIRST, the warmest position is to be chosen, such as is sheltered from the north and north east; and the caldaria^{1*} and tepidaria^{2*} should be lighted from the winter west^{3*}, or, if that is opposed by the nature of the place, from the south;

Fig. XLVIII.

(1*) The hot bath, or sudatory.

(2*) The warm apartment.

(3*) Meaning that point in the horizon where the sun sets at the winter solstice, that is nearly south-west; this is

the position of all the Roman thermæ, whose ruins are still to be seen; their fronts are north-east; and back fronts, in which the baths probably were disposed, are south-west.

because the principal time of bathing is from noon to the evening. It must also be observed, that the caldaria for the women should be contiguous to that for the men, and be exposed to the same aspect; for thus the same hypocaustum^{4*} may suffice for the vafaria^{5*} of both.

Fig. XLVIII. OVER the hypocaustum three caldrons are disposed; one the caldarium (c), and L. another the tepidarium (b), and the third the frigidarium (a). They are so disposed, that as much water may flow into the tepidarium, as runs from thence into the caldarium, and in like manner from the frigidarium into the tepidarium; and the contours^{7*} of the channels^{8*} are heated by one common hypocaustum.

Fig. LI. THE suspensures of the caldarii are thus formed: First, the bottom (a) is to be paved with foot and half tiles, inclining toward the hypocaustum, that if the fuel should be ejected, it may meet no resistance inwardly, but roll back again to the entrance of the furnace; for thus the fire will naturally spread itself under the suspension. Upon this eight inch earthen pillars (b) are raised, and so placed, that tiles of two feet may rest thereon;

(4*) The furnace.

(5*) The vafaria I suppose to be the apartment containing the vessels wherein the water was heated. This passage gives us to understand that each hot-bath had its respective set of cauldrons.

(6*) The vessels containing the hot, warm, and cold water.

(7*) Various are the conjectures of the commentators concerning the manner in which these cauldrons were situated and connected together: but the description is not sufficiently determinate to enable us to fix on any one. I shall, however, give the representation of an ancient painting found in the thermæ of Titus, first published in Maffei's collection, wherein these vases, or cauldrons, appear discharging the water into one another, as Vitruvius describes. See Fig. XLIX.

Galiani has so disposed these cauldrons, that the frigidarium, though the most distant from the fire, must be heated equally with the caldarium; for the pipe of communication, which he has placed at bottom, unites the water in the three vessels into one body; by which connexion, the most distant part is equally heated with the nearest, the whole mass making a circulation to and from the fire. This, I imagine, he has been led into by a desire to situate the vases all on a level; but the vases may be disposed all on a level, and the current of water from one to another preserved, as Vitruvius directs, without placing the pipe, which discharges the water from one into the other, at the bottom of each vessel. If the discharging pipes are made so much higher than one another as is equal to the diameter of one of the said pipes,

it will be sufficient to answer the end. The pipes, being then placed at the top of each vessel, will convey the water from the frigidarium to the other vessels, without any possibility of the heat from the caldarium being communicated to the frigidarium, &c. See Fig. L.

With regard to the mode of supplying the baths, I imagine that, from the reservoir, or aqueduct, a constant stream of fresh water ran into the frigidarium, where it became warm; from thence it ran into the tepidarium, in which it was made hot; and then ran into the caldarium, where it received the greatest degree of heat; and from thence, a continual stream of hot water was conveyed by pipes into the bath, being tempered by a mixture of cold water, from the reservoir, to the degree required. From the bath also, the same quantity of water that entered continually ran off, by waste pipes or drains, at the top; thus, the dirt and impurities floating on the surface, and arising from the bodies of those who bathed, was continually carried off by the stream, leaving the water of the bath always pure and clean.

(8*) *Alvei*, I translate *channels*; for it is doubtful whether Vitruvius means by this word the vacuities of the cauldrons, or that of the baths, or some other kind of voids, or channels (for it is thought there were channels, or fiefs of masonry, or fictile ware, used to convey hot and warm air into the caldaria and tepidaria, and which were also brought from the same hypocaustum).

A little farther, *alveus* is mentioned with *labrum*; and by some supposed to signify the same thing (that is, the bath itself). It is certain that it is not there used for the cauldrons; but neither is it (in my opinion) for the void of the bath, as is observed at note 11*.

the height of the pillars is two feet; they are made with clay, having hair beaten therein; and upon these two-foot tiles (c) are laid, which support the pavement.^{9*}

Concerning the floors, if they are of masonry they will be most servicable; but if they are of timber they must be plastered underneath, which is to be done thus:—Iron bars or arcs are made, and, with prongs of iron, hung to the floor, very close together. These bars or arcs are so disposed, that tiles without margins may lie between every two, and the whole arch is to be thus completely braced with iron. Then the joints on the upper part of these arches are to be stopped with beaten clay and hair; the under part, which is toward the pavement, being first plastered with pounded tiles and lime, and afterward made smooth with stucco or white plaster. If, in the hot apartments, these arches are made double, they will answer the end better; for the humid vapours cannot then corrupt the timbers in the flooring, but they will be dissipated between the two arches.

The magnitude of the baths should be suited to the number of the people.
 Fig. XLVIII. They are thus proportioned:—A third part being deducted from the length, the remainder makes the breadth, exclusive of the schola (d), of the bason (f), and the channel (e).^{10*} The bason (f) is so disposed under the light, that those who stand around may^{11*}

(9*) It has been doubted whether Vitruvius means, by the *cal-darii* here mentioned, the cauldrons containing the hot water, and which he has just before mentioned, or the hot bathing apartments; for he gives them both the same appellation. Barbaro, in his translation, determines for the former, which was once my opinion: but I am now convinced that Galiani's opinion is just, and that the latter is to be understood; for the remains of several ancient baths, of late years discovered, shew that the floors of the hot apartments were supported (or suspended, as it is termed), in the manner here described.

Vitruvius has not however informed us how the cauldrons were supported over the furnace. In the ancient painting, Fig. XLIX. they are represented standing upon arches, covering small channels or flues underneath, where the fire appears: this indeed agrees very well with the latter words of the preceding paragraph—*testudinesque alveorum ex communi hypocausti calefacientur*; for the word *testudines*, which I have rendered *contours*, generally means arched coverings of some kind. Vitruvius also says these *testudines* are heated by the *hypocaustum*, and this appears to be the case by the painting; so that the mode of supporting the cauldrons may have been as thereby represented. This observation may assist the preceding note (8), concerning the *alvei*; for if the *testudines*, as is probable, be the arched tops of the channels or flues of the *hypocaustum*, the *alvei* must signify those flues themselves. That however cannot be the only meaning of the word *alveus*, as will appear here following: it was probably a general term applied to any kind of hollowed or channelled object.

This ancient painting also shews that the hypocaustum extended under several apartments, the hot-bath, sudatory, laconicum, and tepidaria, as well as being under the cauldrons; and the same fact has been found to be exemplified in the remains of most of the ancient baths that have been discovered.

(10*) The *schola* is the walk or pathway, around the bason of the bath, as Vitruvius presently intimates.

(11*) At note (8) I have expressed my uncertainty concerning the *alvei*, and at note (9) given my ideas of them in that passage. But in this the word *alveus* must mean something different. It cannot be the great bason or labrum itself, of the proportion of which Vitruvius is speaking; for, a few lines farther, he says it is but six feet wide; or, when the pulvinus and lower step are deducted, but four feet: which is not probable to have been the width of a public

bath among the ancient Romans. Pliny describes his own private bath at Laurentinum to have been large enough to swim in; and in some of the ancient baths the bason has been found to be of a considerable size. That discovered in the city of Bath, in the year 1755, had a bason 19 feet 3 inches broad, 27 feet 3 inches long, and 4 feet deep; and the baths lately discovered at Baden-Weiler in Germany, published by Governor Pownall, in the *Provincia Romana of Gaul*, appear, by the scale, to be of nearly the same dimensions.—These latter are the most complete examples that have come to our knowledge, and well deserve a full and accurate delineation.

It is highly probable then that the word *alveus* does not here mean the labrum or great bason; but it must certainly mean some part within the bathing-room, from the manner of its being mentioned in the description thereof. The words *præter scholam labri & alvei*—exclusive of the schola of the bason and of the alveus, give us to understand that the alveus had a schola as well as the bason: it is, farther on, said to be between the wall and pluteum; it must then have adjoined the wall, and have had a pluteum or fence on the opposite side. This circumstance, the general meaning of the word, and a lower step being mentioned, and said to occupy a portion of it, argue it to have been some excavation below the rest of the floor; the fence on one side being a requisite guard in such a case, the wall serving instead on the other side. These circumstances excite the idea that it was a smaller bath or bason (e), adjoining the wall of the room, on one side of the great bason (f); but with a path or schola (g) between the two, which might be deemed the schola of the alveus.

The use of such smaller baths can only be conjectured: various reasons might make it proper to separate some persons from the generality, and they might be for their use; or for children, for whom the common bath might be too deep. Such, however, were certainly in use: the ancient painting, Fig. XLIX. represents them. They were found in the ancient baths of Baden-Weiler, twenty inches only in depth; and Vitruvius, book ix. chap. 3, mentions such by the name of *folium*. This latter must have been a small bason, since the body of one man caused it sensibly to overflow; and the mention of overflowing is a probable evidence that it was not one of those sunk within the floor, but raised above, or standing on it; for the former could not overflow, as the water must run into them again. The term *folium* therefore might be applied

not obscure it with their shadows. The *scholæ* of the *basons* should be made so broad, that, while the first comers are bathing, the surrounding spectators may wait commodiously. The breadth of the channel (c), between the wall and the *pluteum*,^{12*} is not less than six feet; for the causeway and step at bottom occupy two feet.

The *laconicum*^{13*} and *sudatories* adjoin to the *tepidaria*. Their height, to the bottom of the curve of the hemisphere, is equal to their breadth, and an aperture for light is left in the middle of the dome, from whence a brazen shield hangs by a chain, by the raising and lowering of which, the heat of the *sudatory* is tempered. This aperture should be made circular, that the heat of the fire and vapour may, from the middle, diffuse equally round the curve of the dome.

C H A P T E R XI.

Of the Construction of *Palestræ*.

Fig. LII. **A**LTHOUGH *palestræ* are not of Italian usage, it seems to me proper to treat of their construction, and of the manner in which they are built by the Greeks. In three porticos (A B C) spacious *exedræ*, having seats, are erected, in which the philosophers,

to such small *basons* as were elevated above or on the floor, and *alveus* to those that were sunk within it.

The remains of the baths at Baden inform us of some other particulars in the æconomy of antient baths, which may not be improperly here noticed. The great *basons* were excavations below the floor of the room, as was also the case in that discovered in the city of Bath; and along the two ends of the *basons* were four steps, each a foot in height, to descend into them; but on the two longest sides were only two steps, two feet high each. The water was introduced through a hole in the face of the upper step; and a leaden pipe was found at the bottom, for the purpose of discharging the whole body of water. The two hot baths, one for the men, the other for the women, were adjoining, as Vitruvius recommends; and the *hypocaustum* was not between them, as represented in *Fig. XLVIII.* but behind them, and adjoining both. The *sudatories* were on each side of the *hypocaustum*, each having a *laconicum* adjoining, which communicated both with the *sudatory* and the hot-bath.

(12*) What the *pulvinus* was, is not explained; Vitruvius gives the same appellation to the flank of the Ionic volute. It may have been some step or seat within the bath, or the stone capping on the wall inclosing the *bason*.

(13*) Perrault, Barbaro, and others have conceived the *laconicum* and *sudatory* to have been the same apartment; which Galiani properly corrects, for in the following chapter they are clearly distinguished. It may be collected from the words of Vitruvius here, and at the 10th chapter of the seventh book, that the *laconicum* was a small room, with a domed or hemispheric ceiling: but

many particulars regarding its size, communication with the *sudatory*, and introduction of the heat, are left unexplained; nor is it sufficiently elucidated by any example hitherto discovered. In the ancient painting, *Fig. XLIX.* it appears as a small stove within the *sudatorium*; and the shield hangs over, as if to close occasionally a tube in the floor through which the flames issue. The description of Vitruvius, however, gives an idea that the shield or shutter was applied to the aperture in the dome above. The communication with the furnace was probably through such an aperture in the floor; but whether the flame, or only the heat, was admitted, is not ascertained. If the flame, and there was a communication between the *laconicum* and *sudatorium*, this latter must have been filled with smoke, unless it passed away through the aperture in the dome above; and, if so, the heat must have passed with it. But if heat only was admitted into the *laconicum*, and there was no other vent for it but through the aperture in the dome of the *laconicum*, then the more or less that aperture was closed by the shield, the more or less heat would be retained in the *sudatorium* (admitting a communication); and thus the shield would regulate the heat, as Vitruvius expresses.

With regard to the size of the *sudatories*, it was probably not great: a great height would impede their use, and require an unnecessary degree of heat to warm them; particularly the lower part, where the people sat. In the ancient painting, the height to the arch appears to be about 10 or 12 feet, or twice the height of the men, which is a probable measure; and this is also about the breadth of the *sudatories* in the examples that have come to our knowledge, agreeing therein with the words of Vitruvius, that the breadth and height, to the bottom of the arch, were equal.

rhetoricians, and others who delight in the sciences, may sit to converse; for, in the palestra's, a peristyle (D) whether square or oblong, is so contrived, that, in the circuit of its ambulatory, it may contain two stadia. This the Greeks call *diaulon*; and herein three porticos (A B C) are formed single; and a fourth (E), which is disposed to the south, double, that the weather, when tempestuous, may not annoy the interior walk.

•IN the double portico these apartments are disposed: The ephebeum (F), which is a vast exedra with seats, is in the middle, and is made a third part longer than broad. Upon the right is the coriceum (G), then the conisterium (H), adjoining; and next to the conisterium, on the returns of the portico, is the cold bath (I), which the Greeks call *lutron*. Upon the left of the ephebeum is the elæothesium (K); adjoining the elæothesium is the frigidarium (L); and from thence is the entrance to the propingium (M), on the returns of the portico. Near by, but more inward, behind the place of the frigidarium, is the vaulted sudatory (N), in length twice its breadth; which has, on the returns, the laconicum (O) on one side,

(1*) Peristyle literally signifies a circuit of columns; it is here to be understood an open area surrounded by a columnade.

(2*) A stadia is a furlong, or eighth part of a mile, containing six hundred and twenty-five Roman feet.

(3*) The words *ad meridianas regiones est conversa*, which I have rendered, *disposed to the south*, are ambiguous; former translators have understood by them, that the double portico should be exposed to the south; but I am of opinion that Vitruvius means it should be placed on the south side of the peristyle, and consequently be exposed to the north; for Vitruvius describes the frigidarium to be next to the portico; and the hot bath, sudatory, &c. to be more inward, and behind the frigidarium; and therefore they must be lighted from the side opposite to the portico.

In the foregoing chapter, Vitruvius has told us that hot baths should be lighted from the south, or south west, to the end, that they might be warmed by the rays of the sun; which could not happen if this portico faced the south; for the hot baths would, in that case, receive their light from the north. On the contrary, if the double portico is placed on the south side of the peristyle, then the baths, being lighted from the side opposite to the portico, will receive their light from the south, agreeable to the directions of Vitruvius, and the frigidarium will very properly face the north; which, according to the interpretation of the translators, would as improperly face the south. It may also be added that the reason given for making this portico double (*viz.* to avoid the tempestuous weather) corroborates the supposition. The reason Palladius adds (*viz.* to avoid the heat of the sun in summer time) is therefore unsuitable and void.

(4*) The commentators vary in their opinion concerning the use of the coriceum. Some suppose that as the ephebeum was the place of exercise for the youth, so the coriceum answered the same purpose for the girls, *κορυς*, in Greek, signifying girls. Others imagine it to be the spheristerium, or place where they exercised with the ball; and derive the name from one of the kinds of balls they used, which was called *κορυς*. Others again suppose the coriceum to be the same as the apodyterium, or undressing room; this latter conjecture seems the more probable, as the undressing-room was a necessary apartment to the baths; and it is wholly omitted, unless the coriceum was to answer that purpose. Also, the conisterium, or apartment which contained the powder or sand with which they rubbed their bodies, being described to be adjoining, adds some strength to this opinion.

(5*) The cleothesium is the room where they anointed, called by the Romans unctuarium.

(6*) This passage plainly distinguishes the frigidarium from the frigida lavatio, or cold bath. What distinct purpose the frigidarium answered can only be conjectured. Galiani thinks it answered the use of the tepidaria in the Roman baths; which was a room of a middle degree of heat, serving for those who had used the sudatory, or hot bath, to rest in a short time, in order to cool the body more gradually. To make another conjecture, it may have been the reservoir of the cold water, from whence the baths were supplied; for Vitruvius has, in the preceding chapter, called the vessel containing the cold water by the same name, and has assigned no other apartment in the palestra for that indispensable purpose.

(7*) Propingium is synonymous with hypocaustum, or furnace.

built in the manner before written; and opposite the laconicum, the hot-bath (P). In the peristyle of the palestræ, the parts are distributed as above written.

OUTWARDLY three porticos are built; one (Q), in passing out from the peristyle, and, on the right and left, the two stadal porticos (R S); of which the one (S) that faces the north is made double, and of a great breadth; the other (R) is single, and so designed, that, in the parts which encircle the walls, and which adjoin to the columns, there may be margins for paths, not less than ten feet; and the middle is so excavated, that there may be two steps, a foot and a half in descent, to go from the margin to the plane (R), which plane should not be less in breadth than twelve feet; by this means, those who walk about the margins in their apparel will not be incommoded by those who are exercising themselves. This portico is, by the Greeks, called *Xyftos*; because, in the winter season, the athletæ exercise themselves in these covered stadiæ.

THE xyfti have groves or plantations (T) between the two porticos, and walks between the trees, with seats of signine work. Adjoining to the xyftus (R), and double portico (S), are the uncovered walks (U), which the Greeks call *peridromidas*, and we *xyftus*; to which the athletæ, in fair weather, go, from the winter xyftus, to exercise. Beyond^{9*} the xyftus is the stadium^{10*} (W), made so large that the multitude of people may have sufficient room to behold the contests of the athletæ. I have now described the proper disposition of all buildings that are found to be necessary in large cities.

C H A P T E R XII.

Of Ports, and of Structures built in the Water.

SOME account of ports, and the means by which ships may be preserved from tempests, must not be wholly omitted. Of these, such as are natural, and have capes, or projecting promontories, from whence there is an inward curve or return, formed naturally, are experienced

(8*) Signinus is a kind of terras. See note 1*. chap. IV. Book II.

(9*) Vitruvius has before told us that the Greeks called the covered place of exercise Xyftus; and here he tells us the Romans gave that name to the uncovered walks. This double and indeterminate signification of that word occasions such a perplexity in the description as renders it

very difficult to be understood, we cannot be certain when Vitruvius means the covered and when the uncovered stadia, and this has been the reason that the draughts of the palestræ, made by the several translators, are so very different to each other.

(10*) The stadium was the place allotted for the performance of the races.

to be the most serviceable; for porticos or arsenals are built around, and a road is made from the porticos to the emporium, having towers on either side, from whence the chains may be drawn by machines.

BUT if the place is not so formed by nature, nor is adapted to secure vessels from tempestuous weather, this method must be used: Walls or bulwarks must be carried forward from one shore, if no river prevents it, or if the stream may be turned, towards the other shore, and, by this means the inclosure of the port must be formed.

THESE structures which are built in the water are to be thus executed: The sand of the country, which extends from Cumæ to the promontory of Minerva, is procured, and mixed with lime, in the proportion of two to one; then, in the intended place, fences of oaken piles, bound with chains, are fixed in the water, and firmly united.

WHEN this is done, the ground at the bottom of the water, between these fences, is, by means of ^{2*}transfilli, cleared and levelled, and rubble stones, with mortar, mixed in the manner before written, is thrown in, till the space between the fences is quite full. The countries above mentioned have this natural advantage.

BUT if these fences should not be able to resist the undulation and violence of the open sea, then, from the same shore, a strong buttress must be built. Half this buttress is built to a level plain, and the remaining part, which is next the sea, has an inclined side. This done, on the part next the sea, and round the sides of the buttress, margins of a foot and an half are built, level with the plain part before-mentioned, and on the inclined side; it is filled with sand to the level of the margins and plane of the buttress; then on this place a pier of a sufficient magnitude is erected; and, when finished, left to dry at least two months. After this, the margins which support the sand are thrown down, and the sand being then washed away by the waves, the pier is precipitated into the sea. Thus, proceeding as often as necessary, the work may by this means be carried forward in the sea.

BUT, in countries where the pozzolona sand is not to be obtained, the following method must be used. In the place proposed, double fences, well bound together with planks and chains, must be erected, and the intervals rammed with loam and bandages made of lake weeds. When they are rammed as close as possible, then the cochlæ, rotæ, and tympani being applied,

(1*) This is the pozzolona sand described at the sixth chapter of the second book.

(2*) What is meant by *transfilli* is uncertain; but it may be supposed they were some kind of machines in use among the ancients, for the purpose of clearing and levelling the ground under the water. Barbaro thinks they were floats, or rafts of timber, on which the men stood to work.

(3*) The signification of the word *meronibus*, which, guided by the sense of the context, I have rendered bandages, is also unknown.

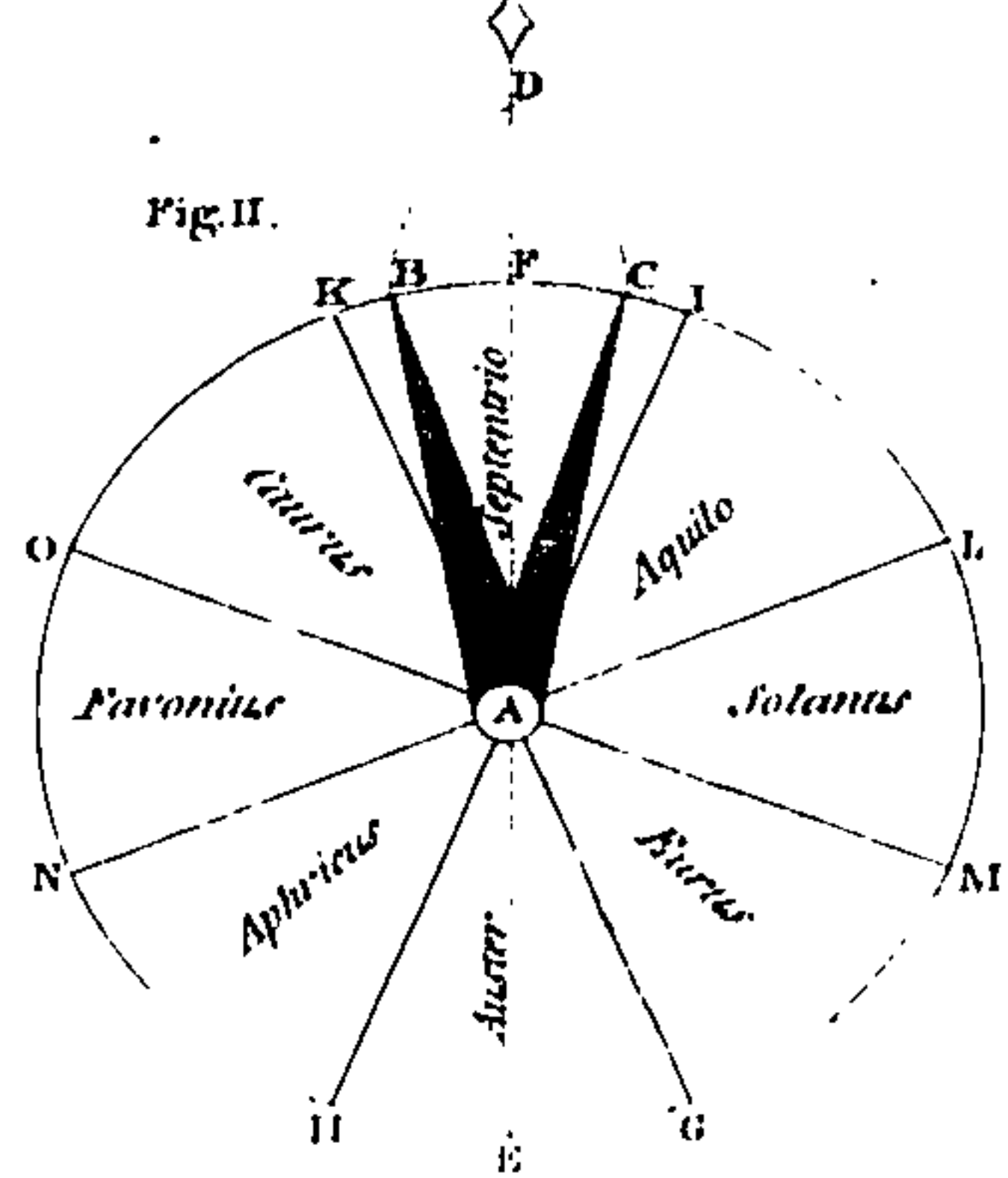
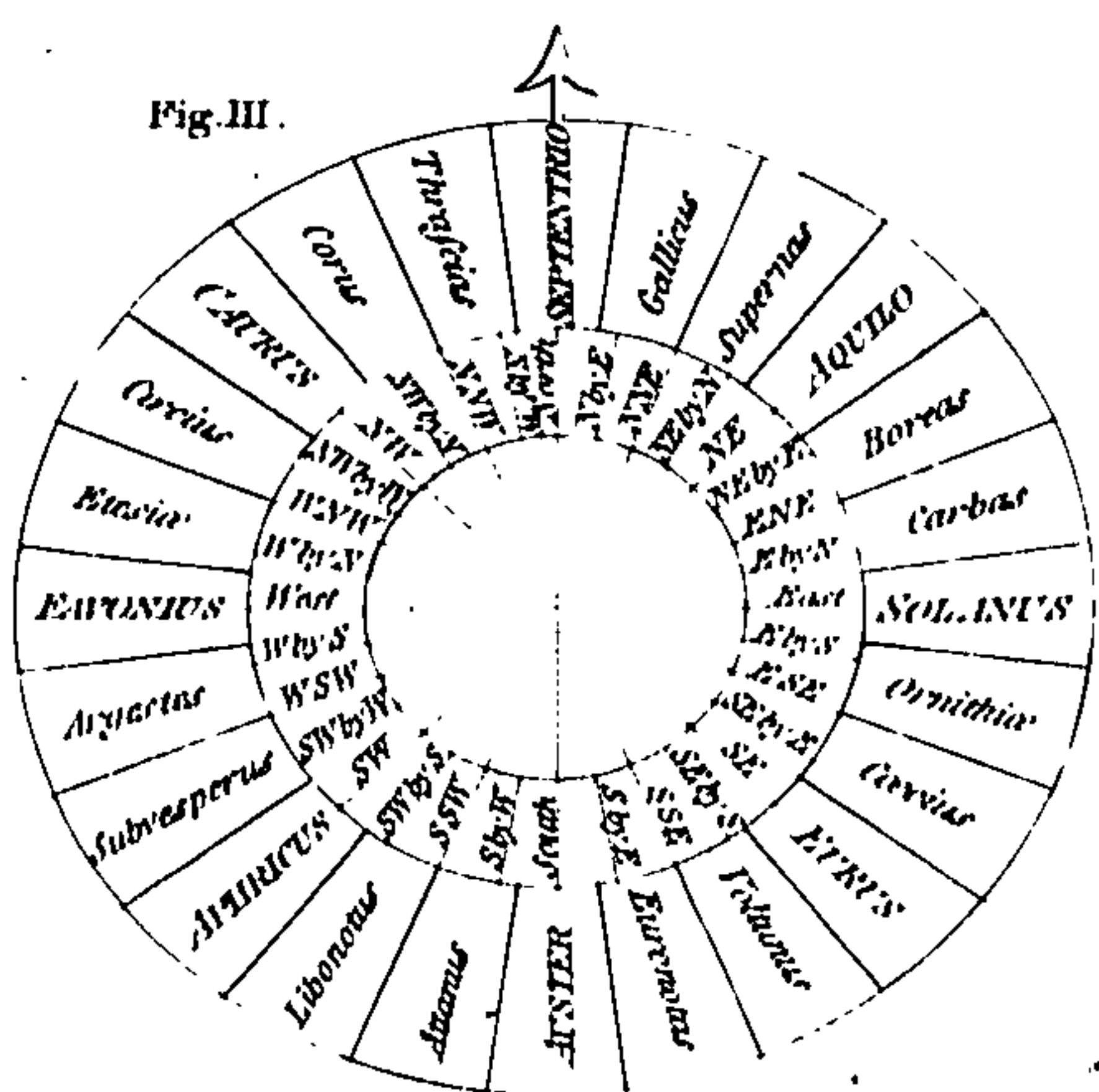
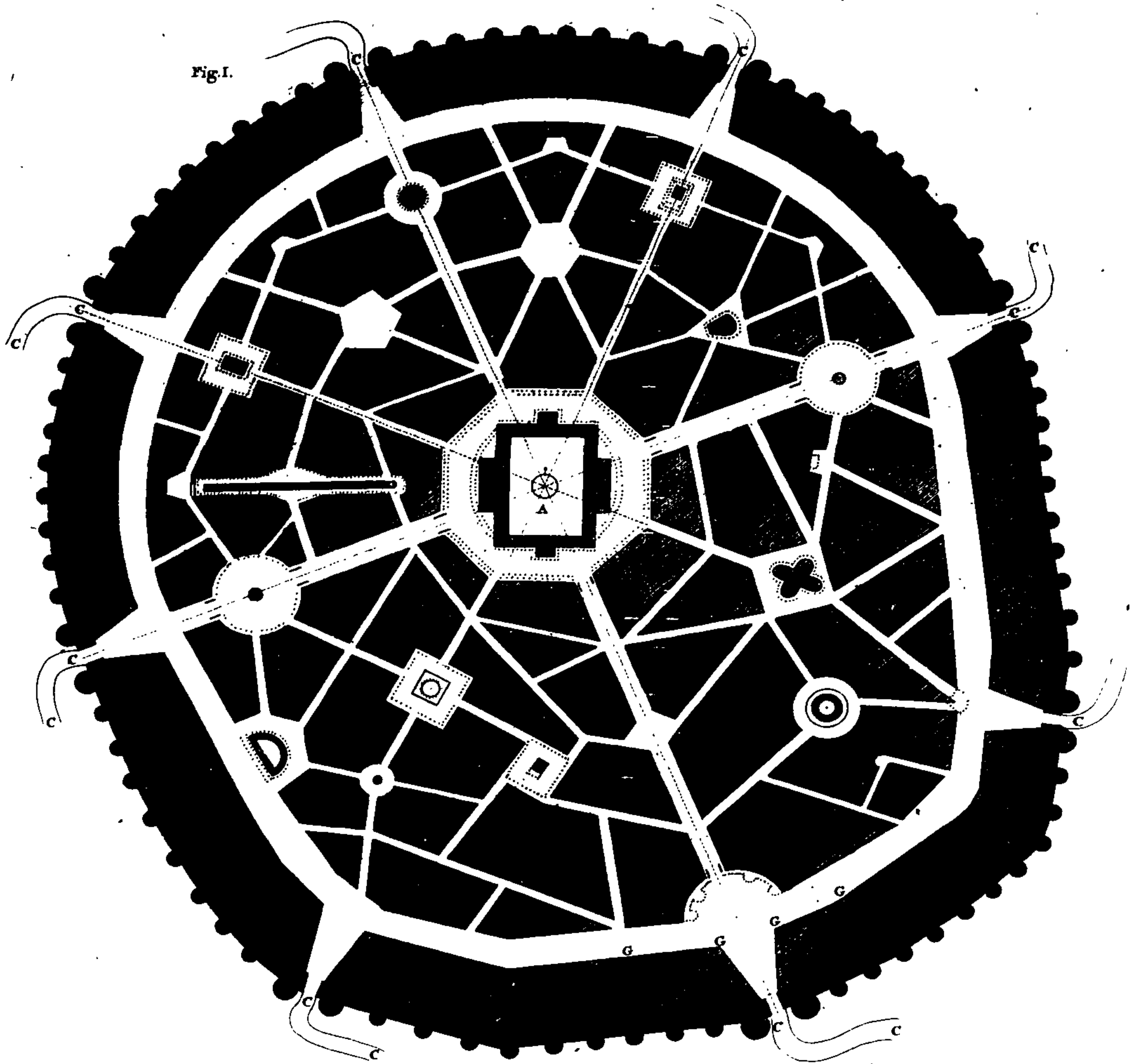
(4*) These machines are described in the ninth, eleventh, and twelfth chapters of the tenth book.

the place between the two fences is emptied and dried; and if the foundation is loose ground, it is dug till a solid bottom is found, larger than the wall which is to rest thereon. When it is thus emptied and dried, the wall is then completed with stones, lime, and sand. But, if the foundation should prove to be infirm, it is to be secured with piles of alder, olive, or oak, scorched, and the interstices rammed with coal in the same manner as has been described for the foundations of theatres and other walls; after which the wall is raised of hewn stones, the joints being as long as possible, that the middle stones chiefly may be secured by the joints. Then the inner part of the wall is filled with rubble or masonry, and thus a tower may be erected thereon.

THIS done, the arsenals are built so as principally to face the north; for the southern aspects, on account of the heat, breed and cherish moths, worms, and other noxious vermin. In these buildings very little timber is to be used, in order to avoid the hazard of fire. With regard to their magnitude, nothing can be determined; they must be made so as to be suitable to the greatness of the navy, and, in case larger fleets should be brought in, that there may be sufficient room to dispose them.

CONCERNING the public buildings which are necessary for the accommodation of cities, and the manner in which they should be designed and executed, I have, as far as they have occurred to me, treated in this volume. The symmetry and convenience of private buildings I shall explain in the following books.

THE END OF THE FIFTH BOOK.



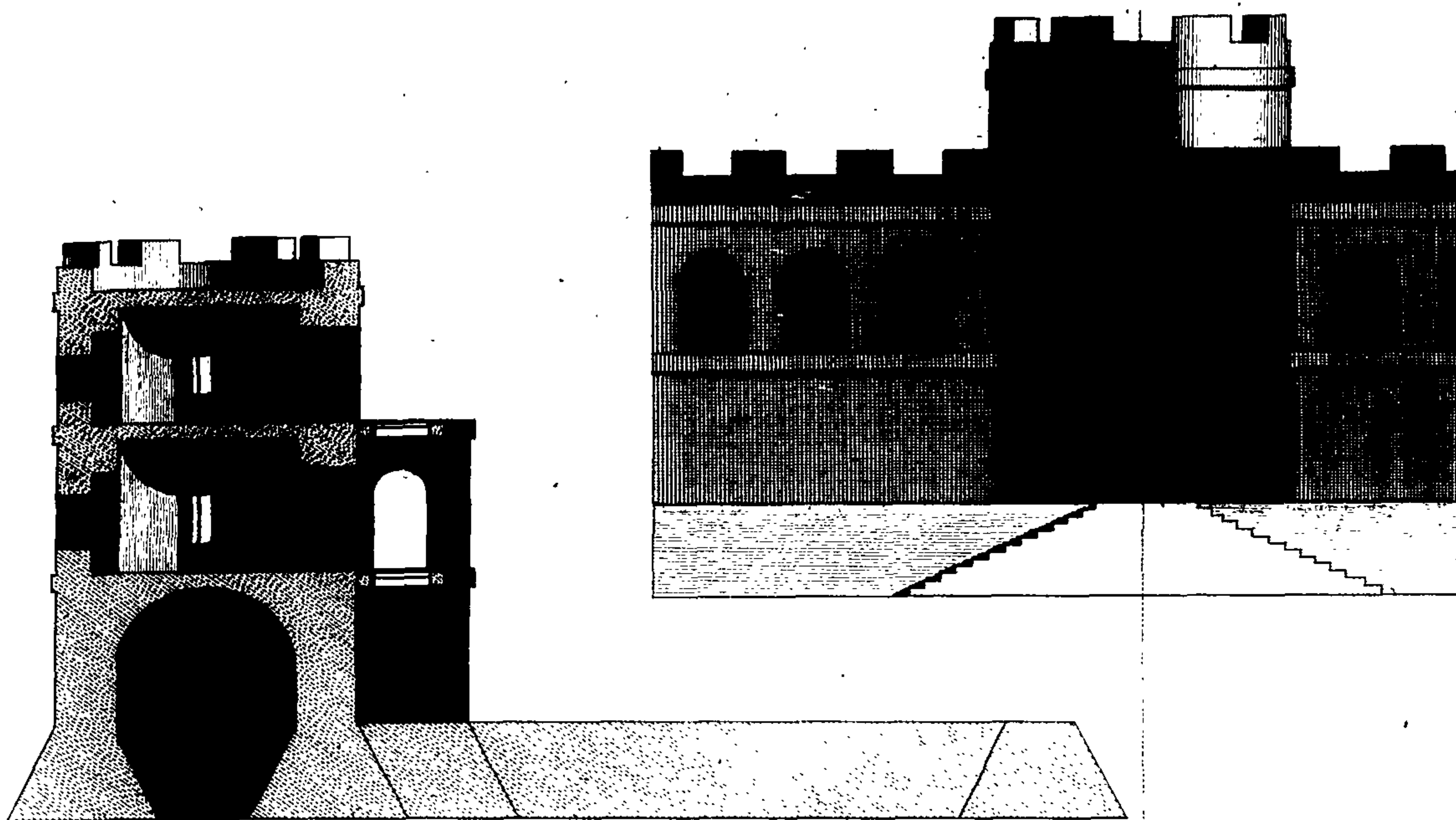
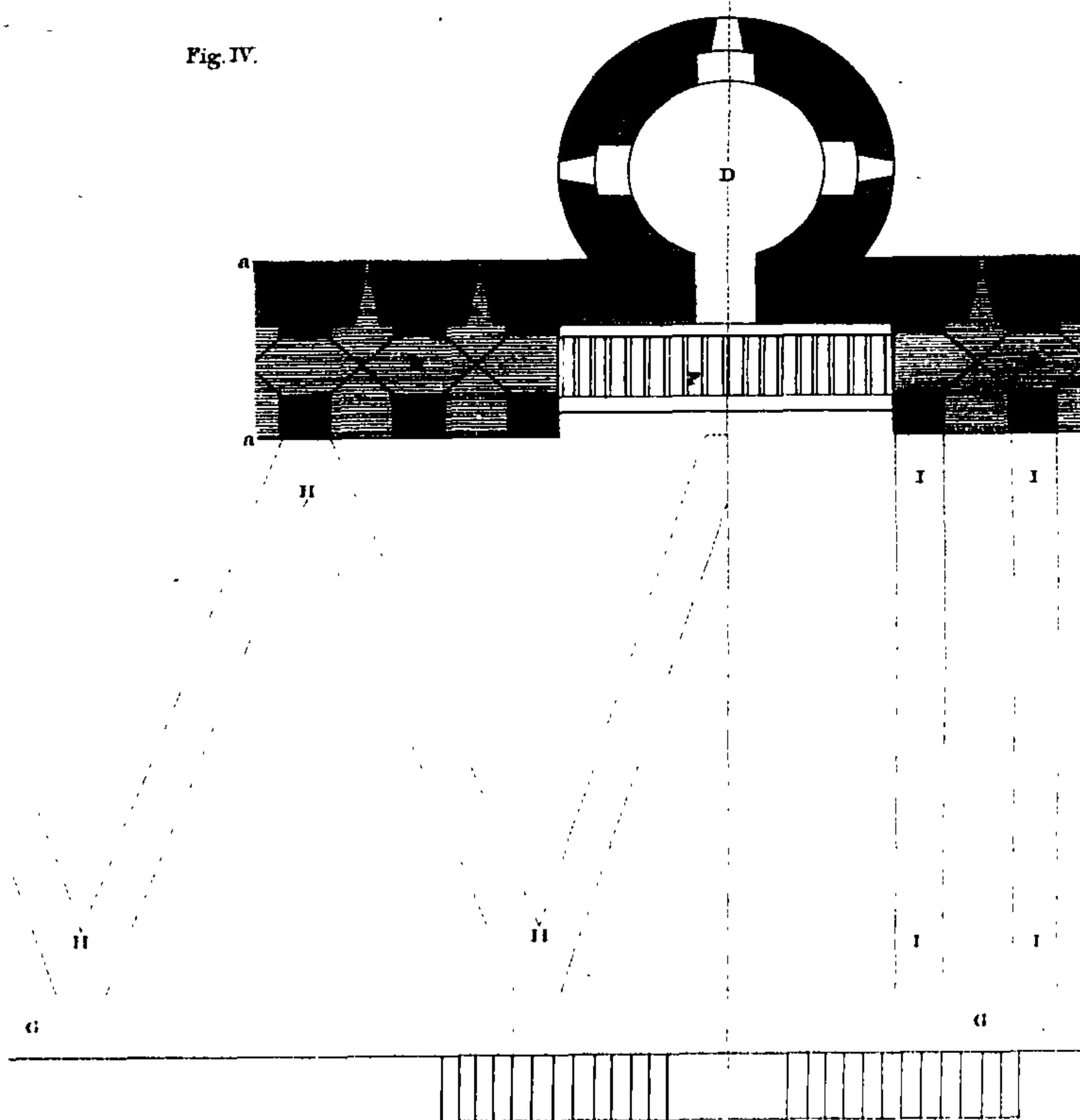
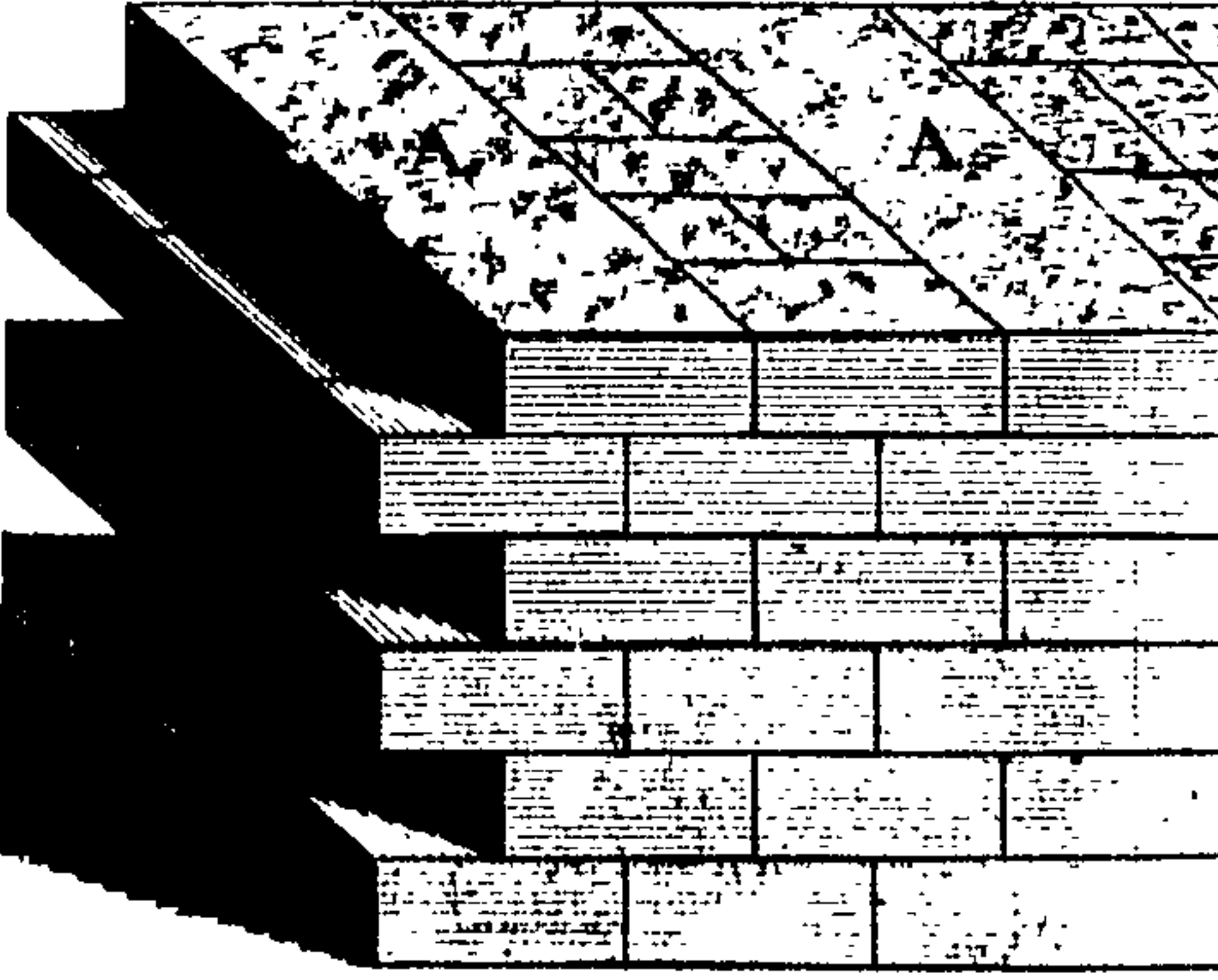
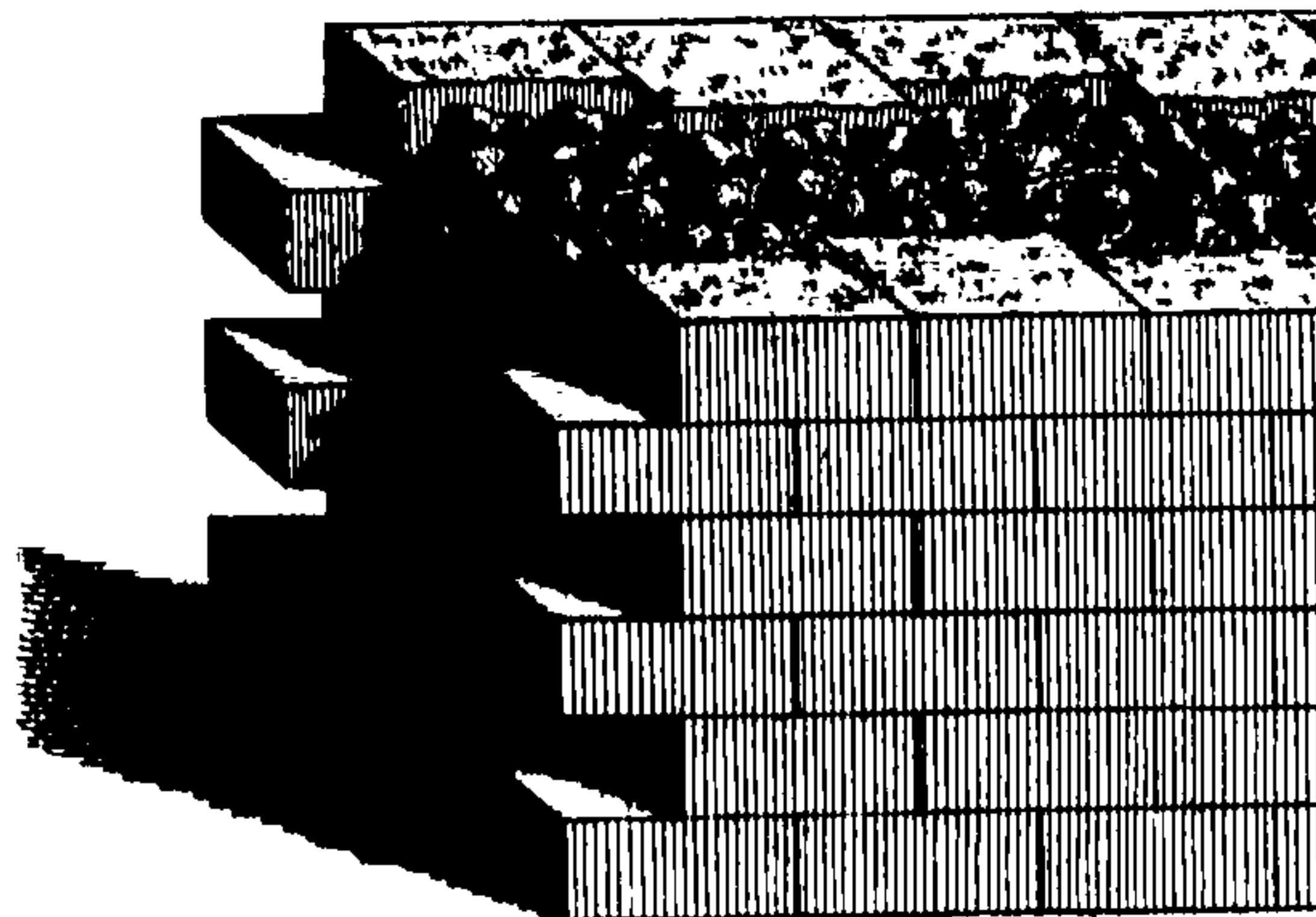
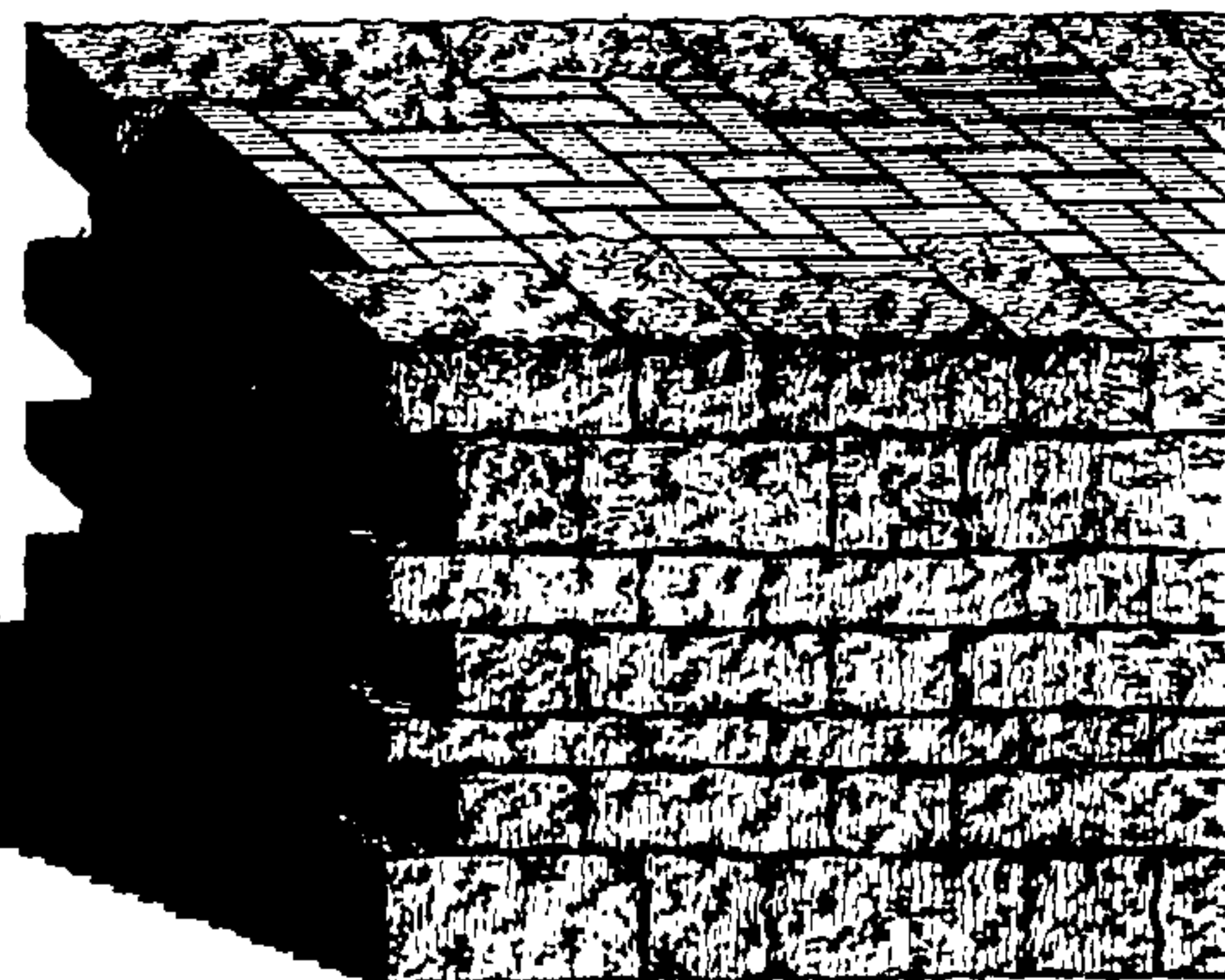
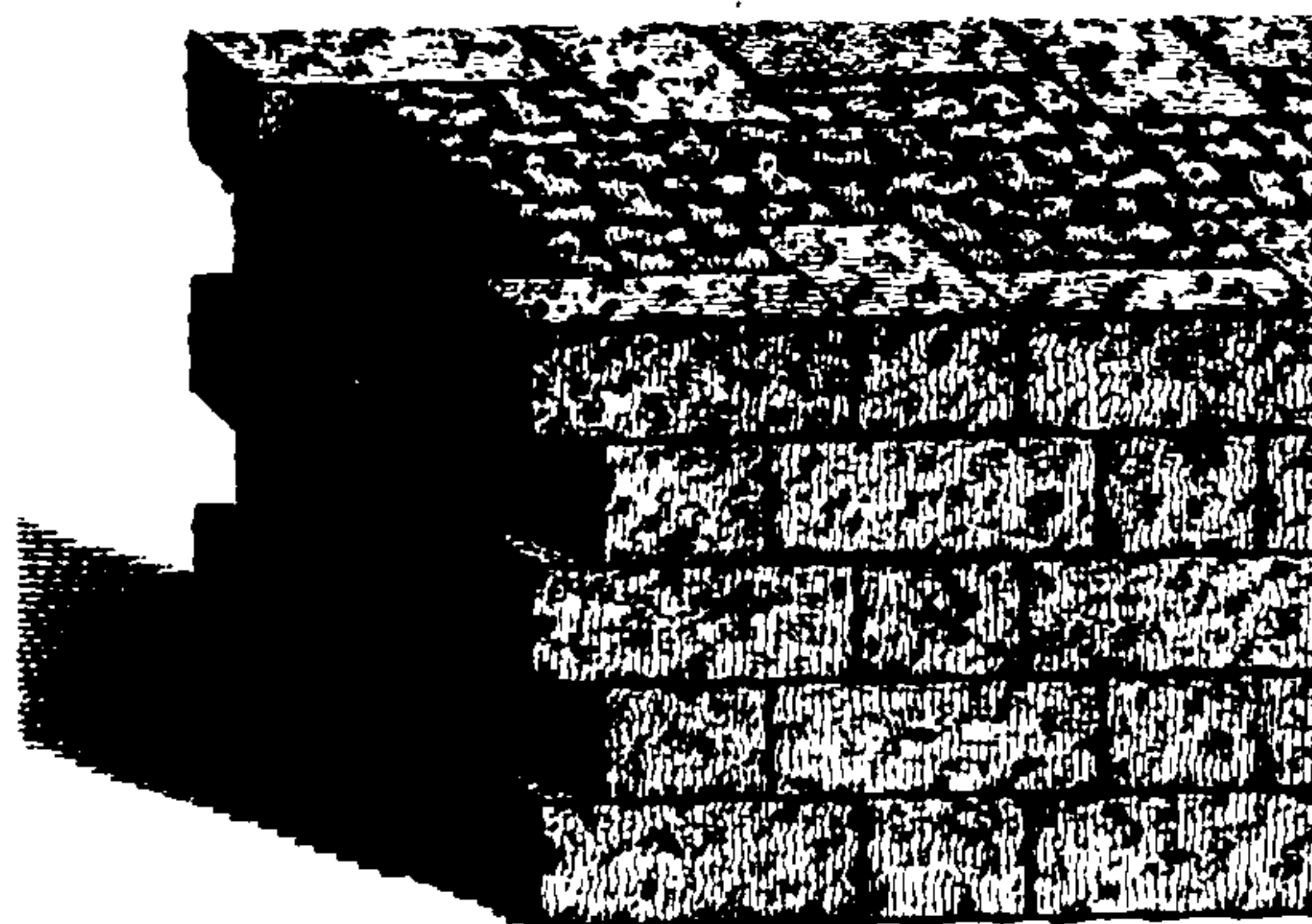
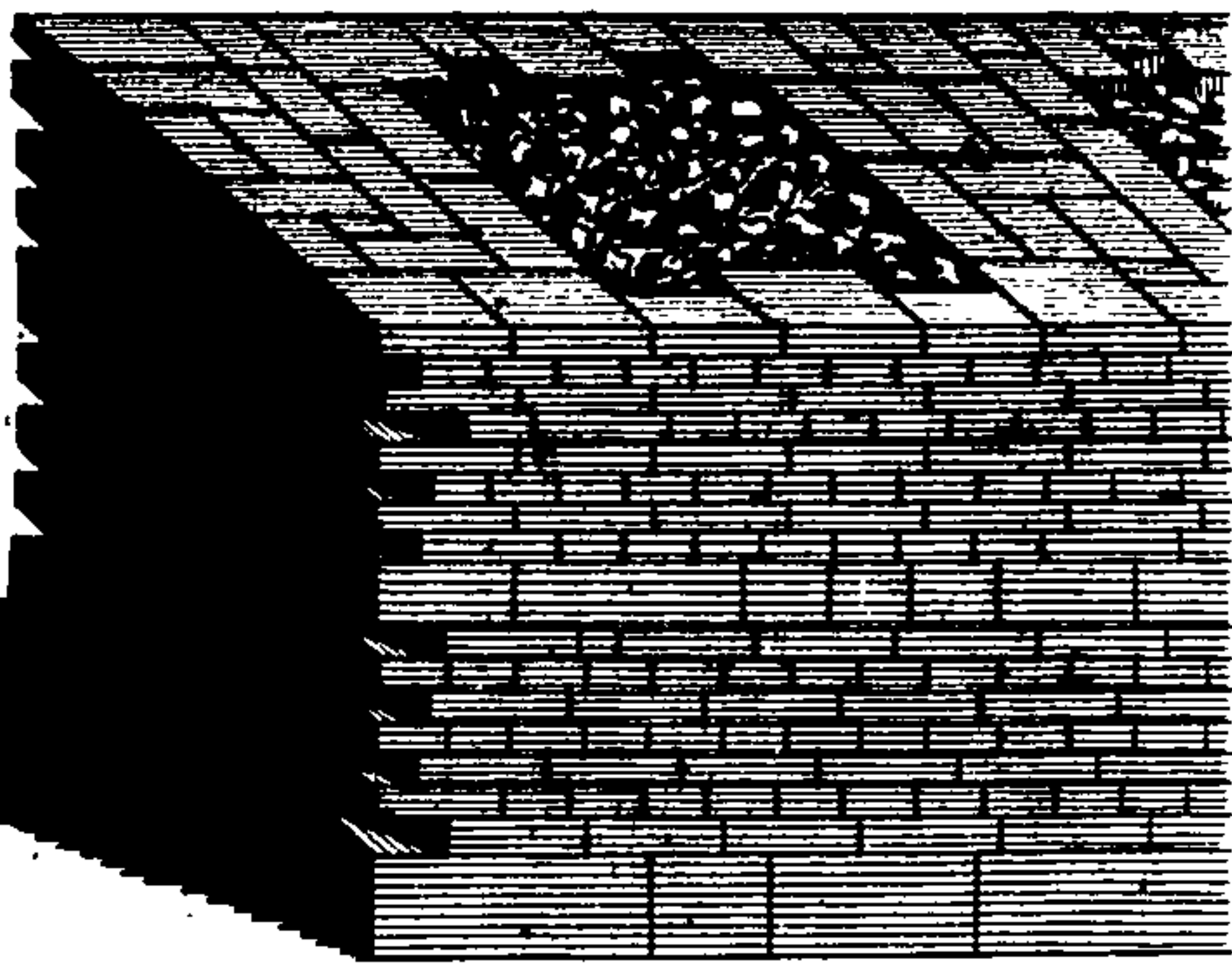
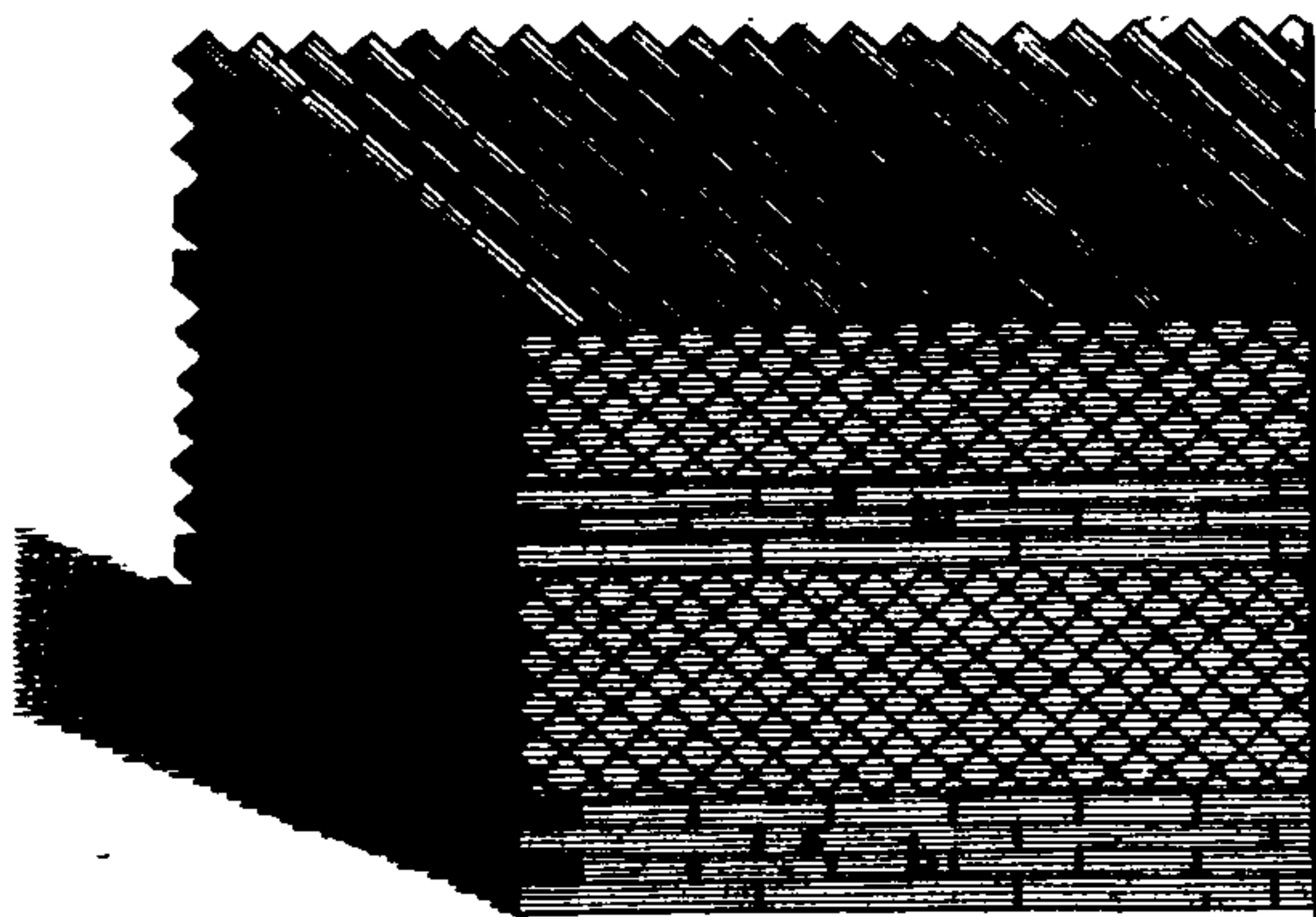
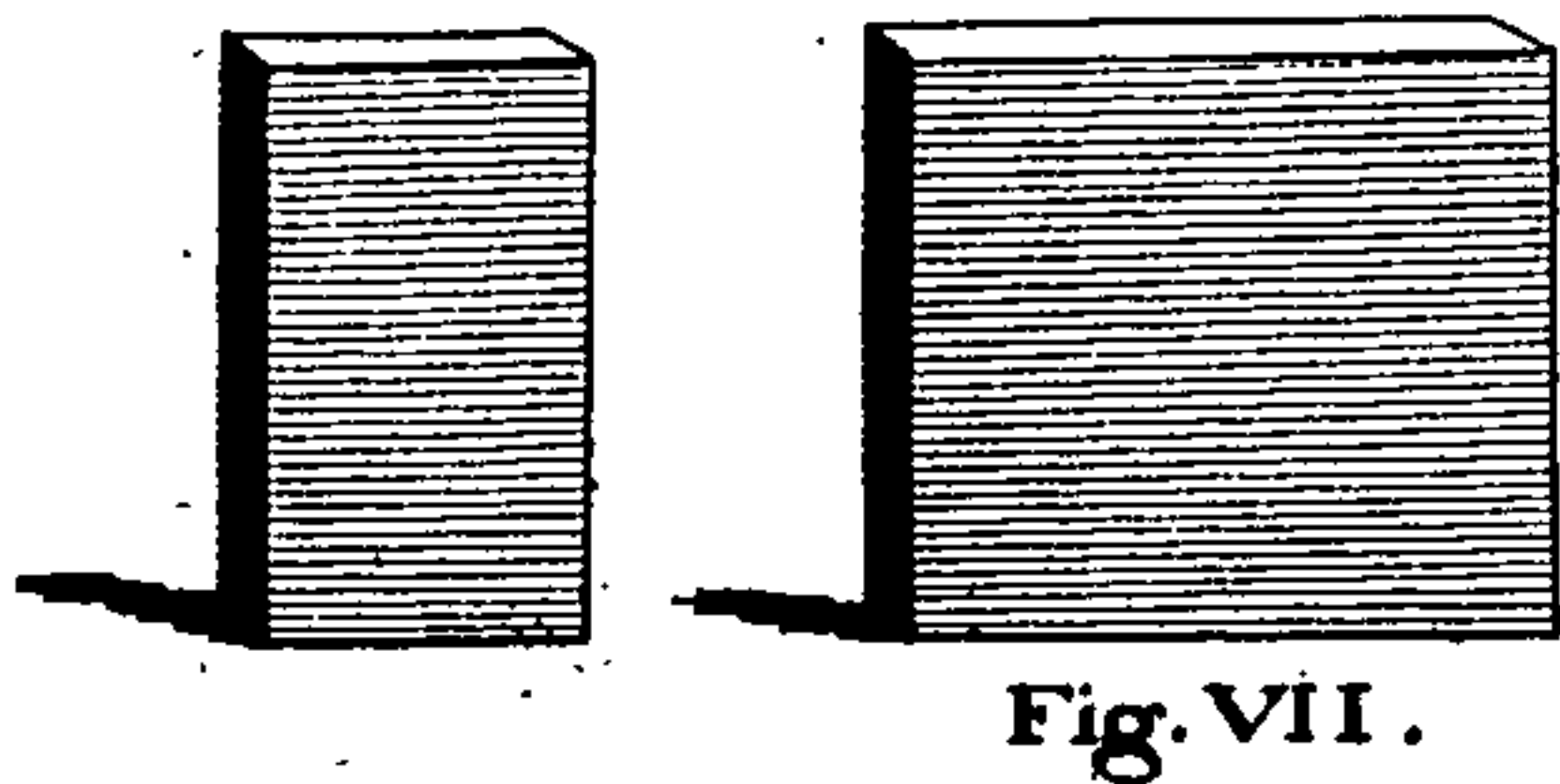
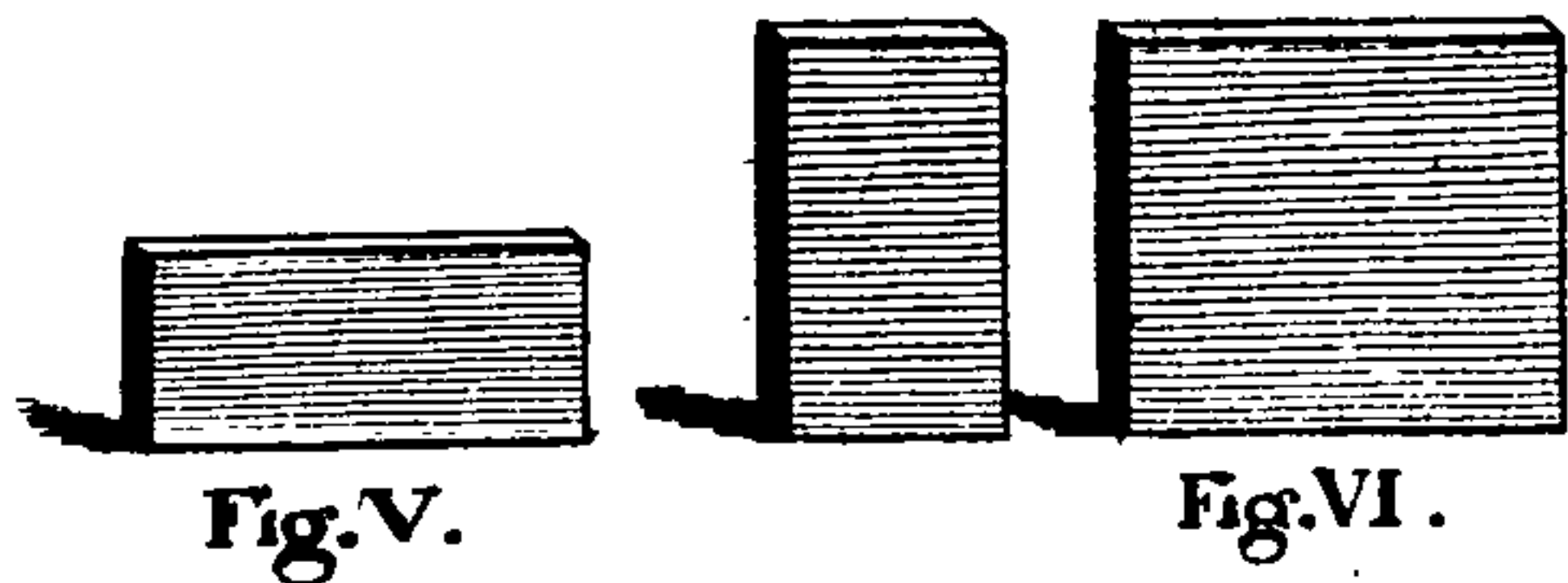


Fig. IV.





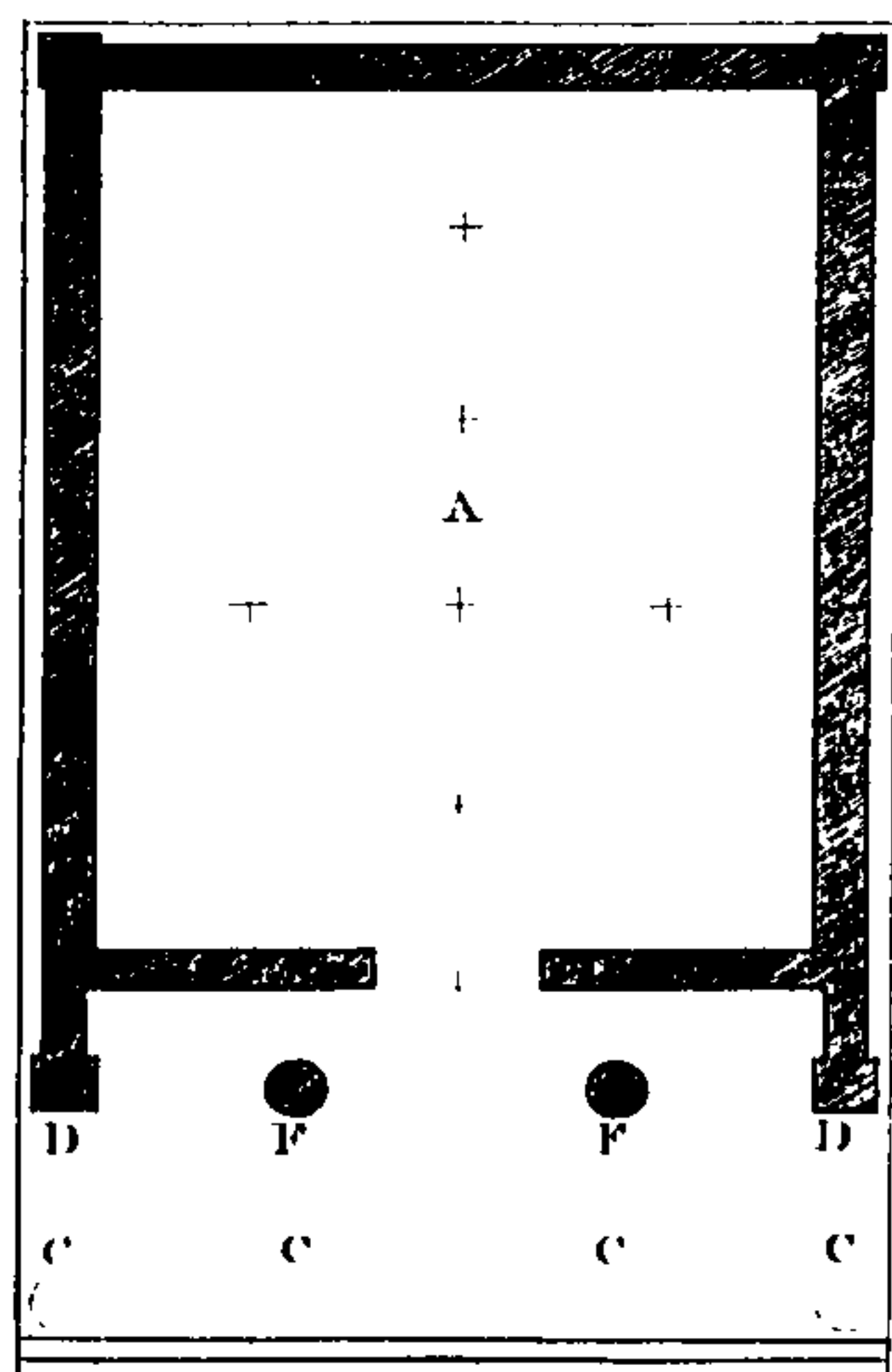
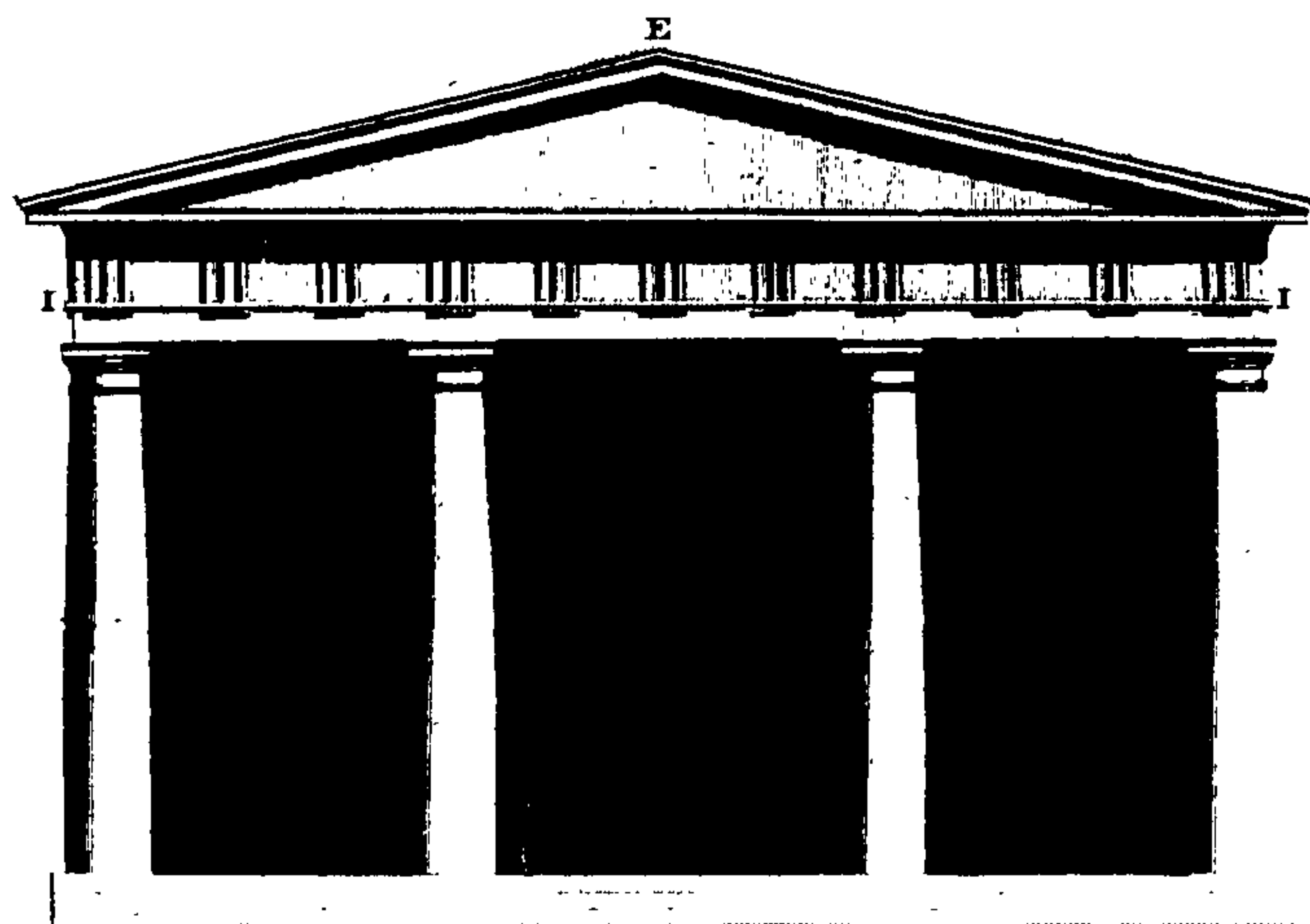


Fig. XIV.

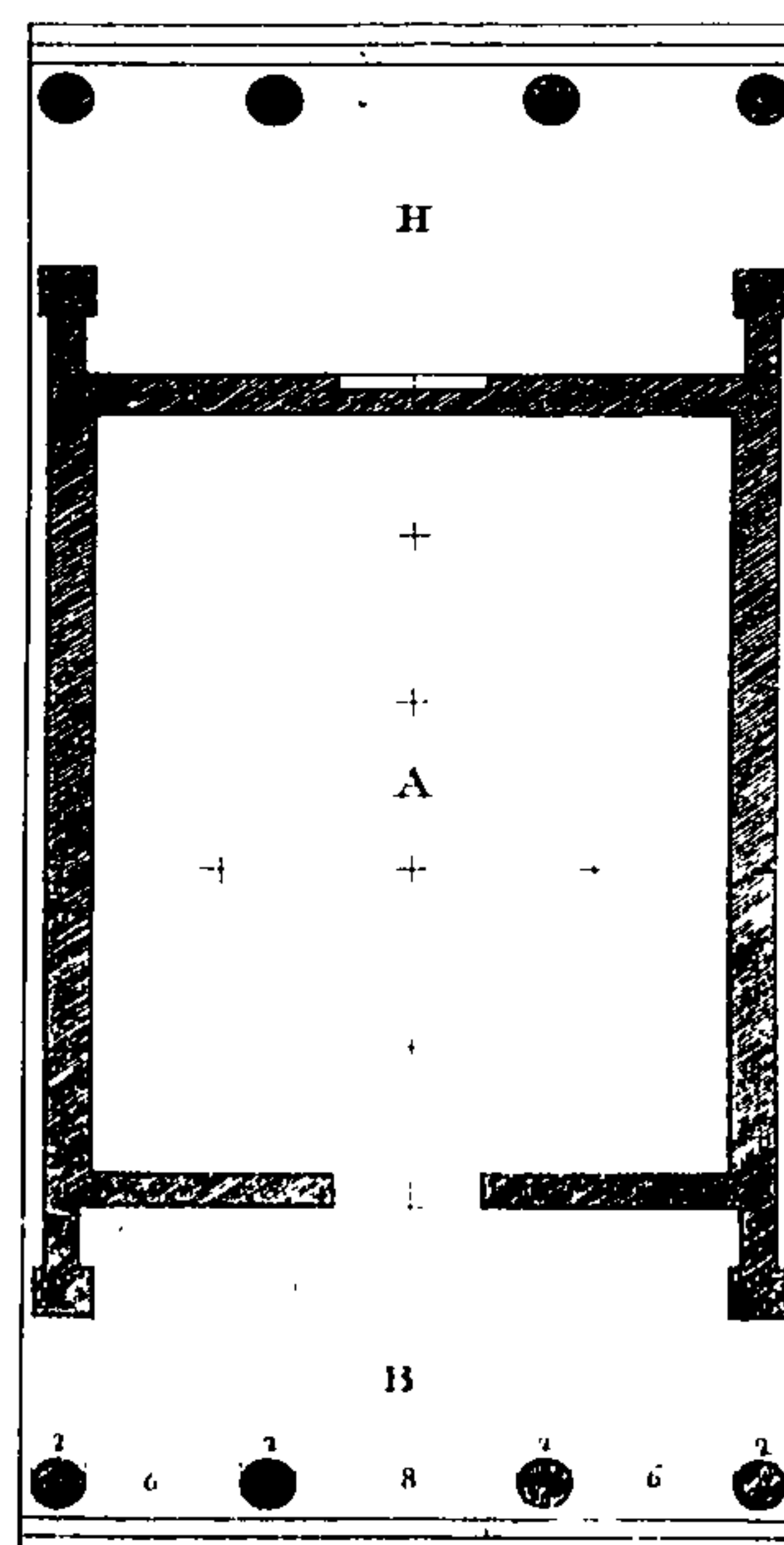


Fig. XV.

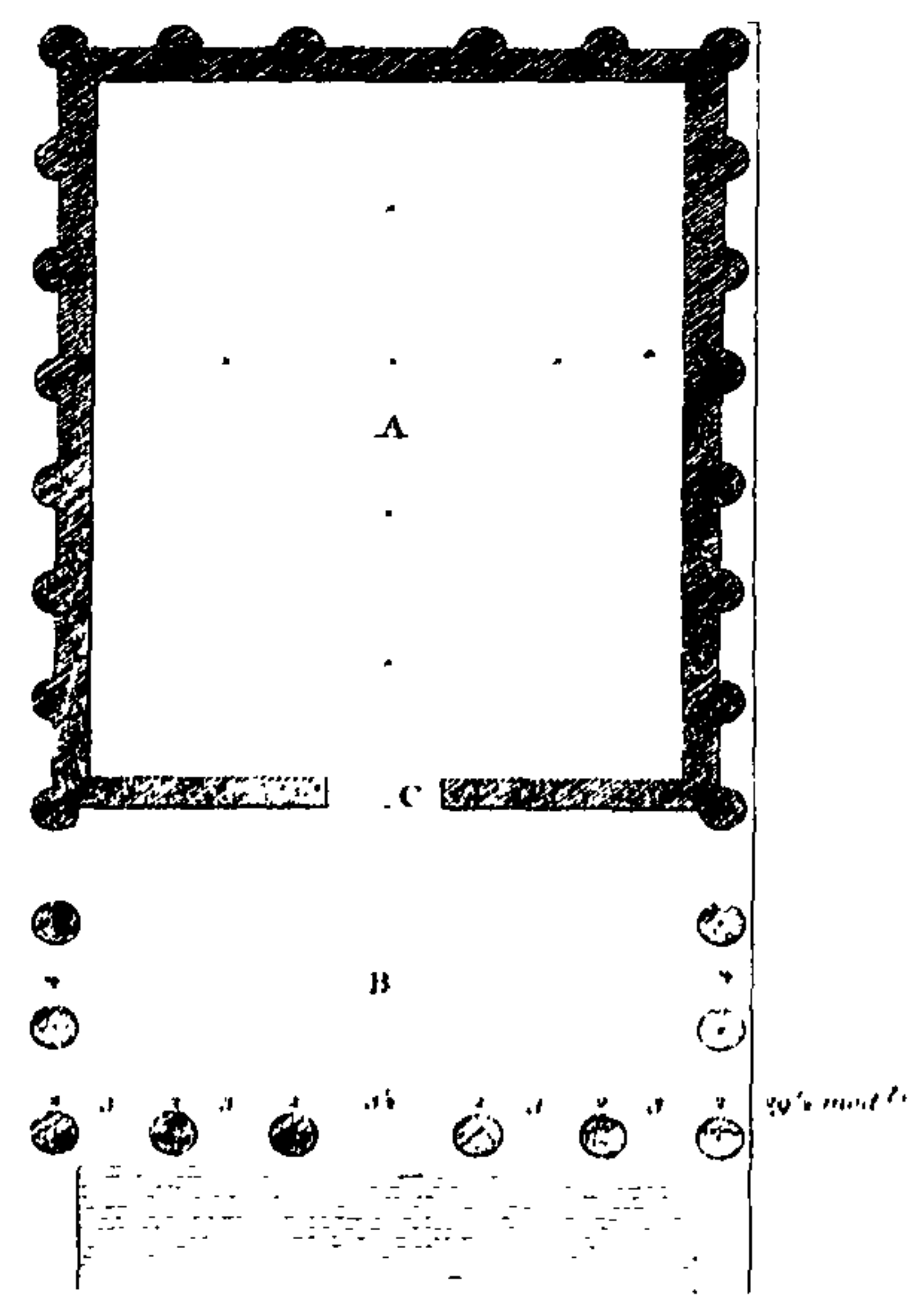
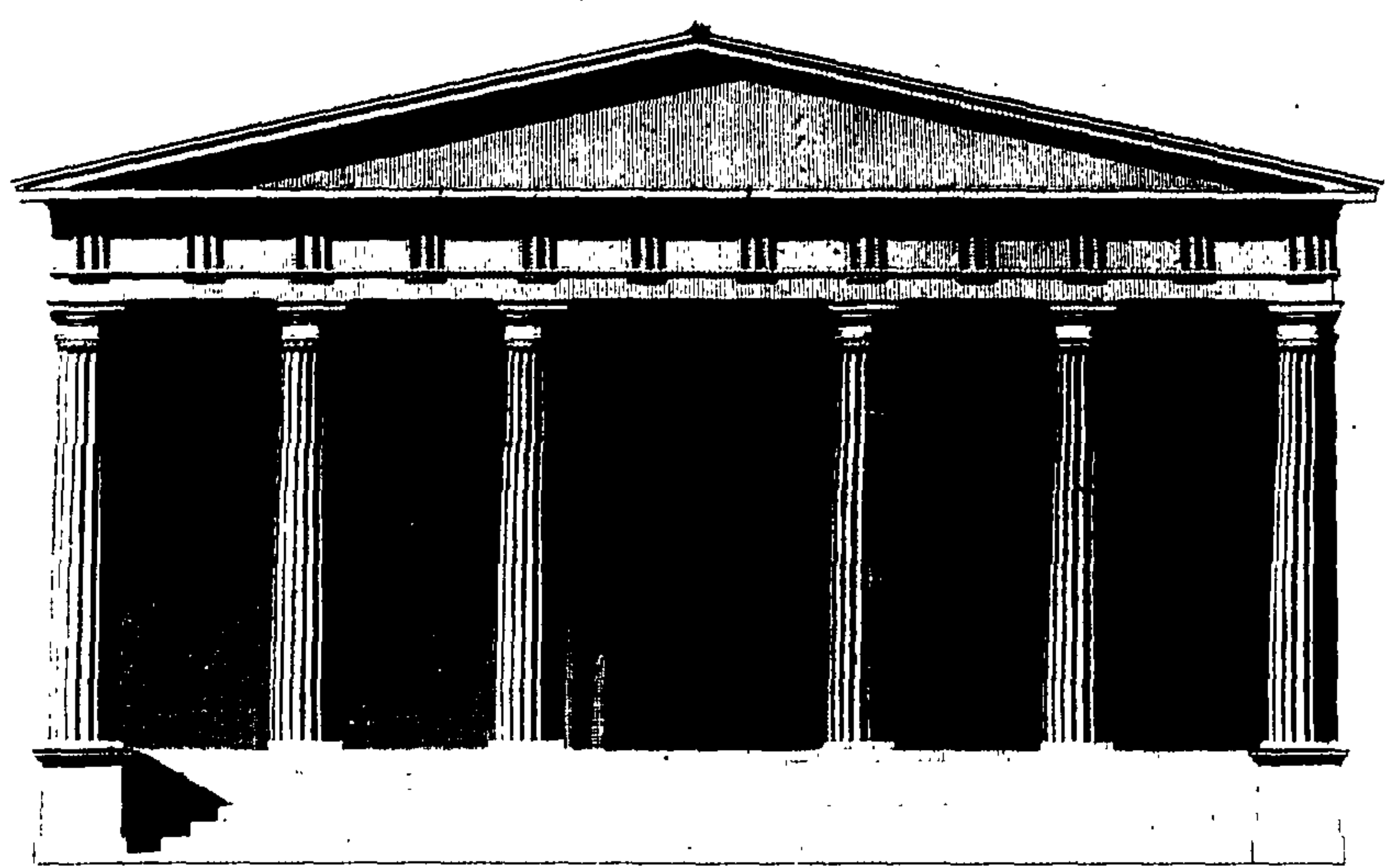


Fig. XVI.

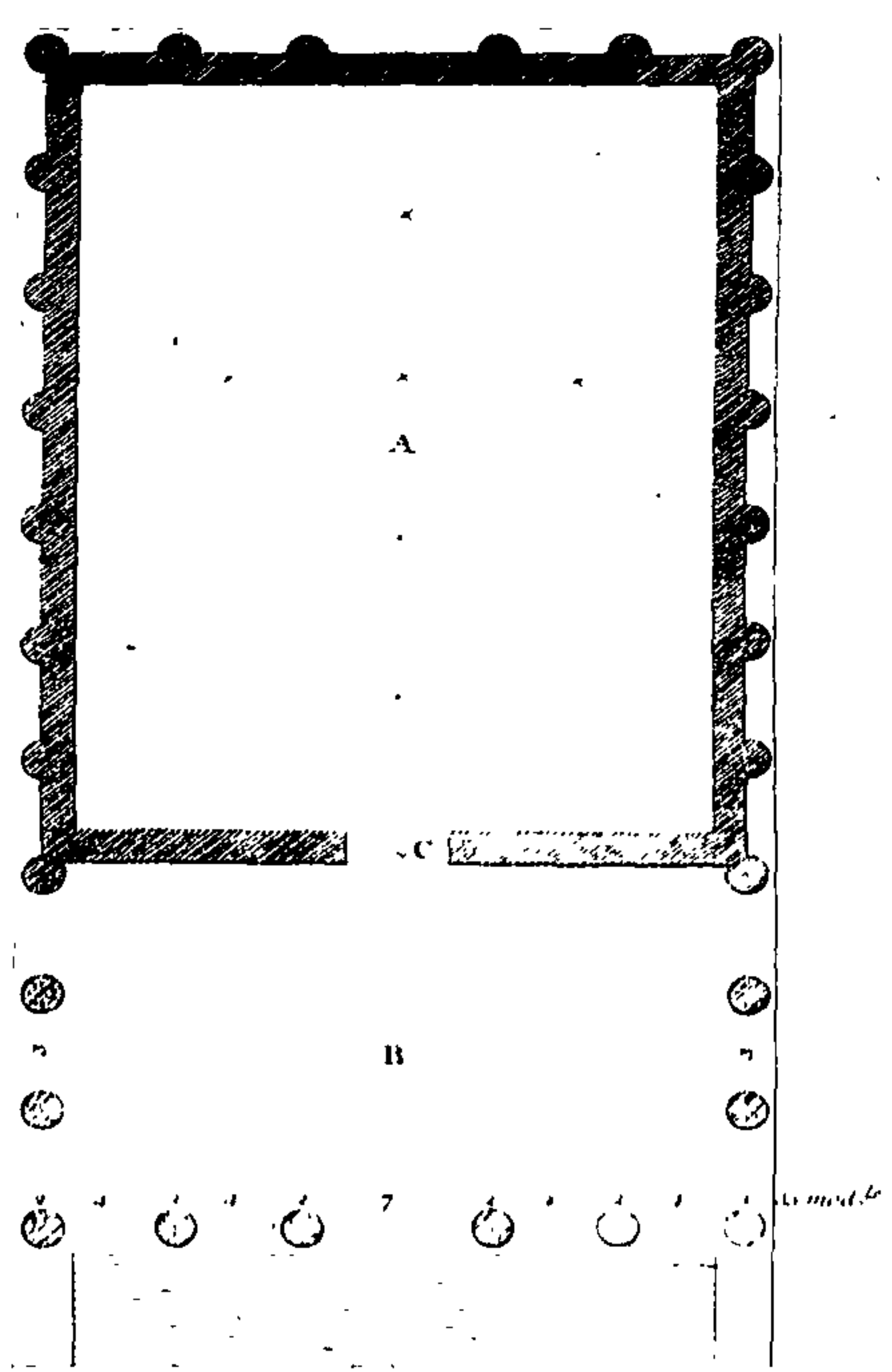


Fig. XVII.

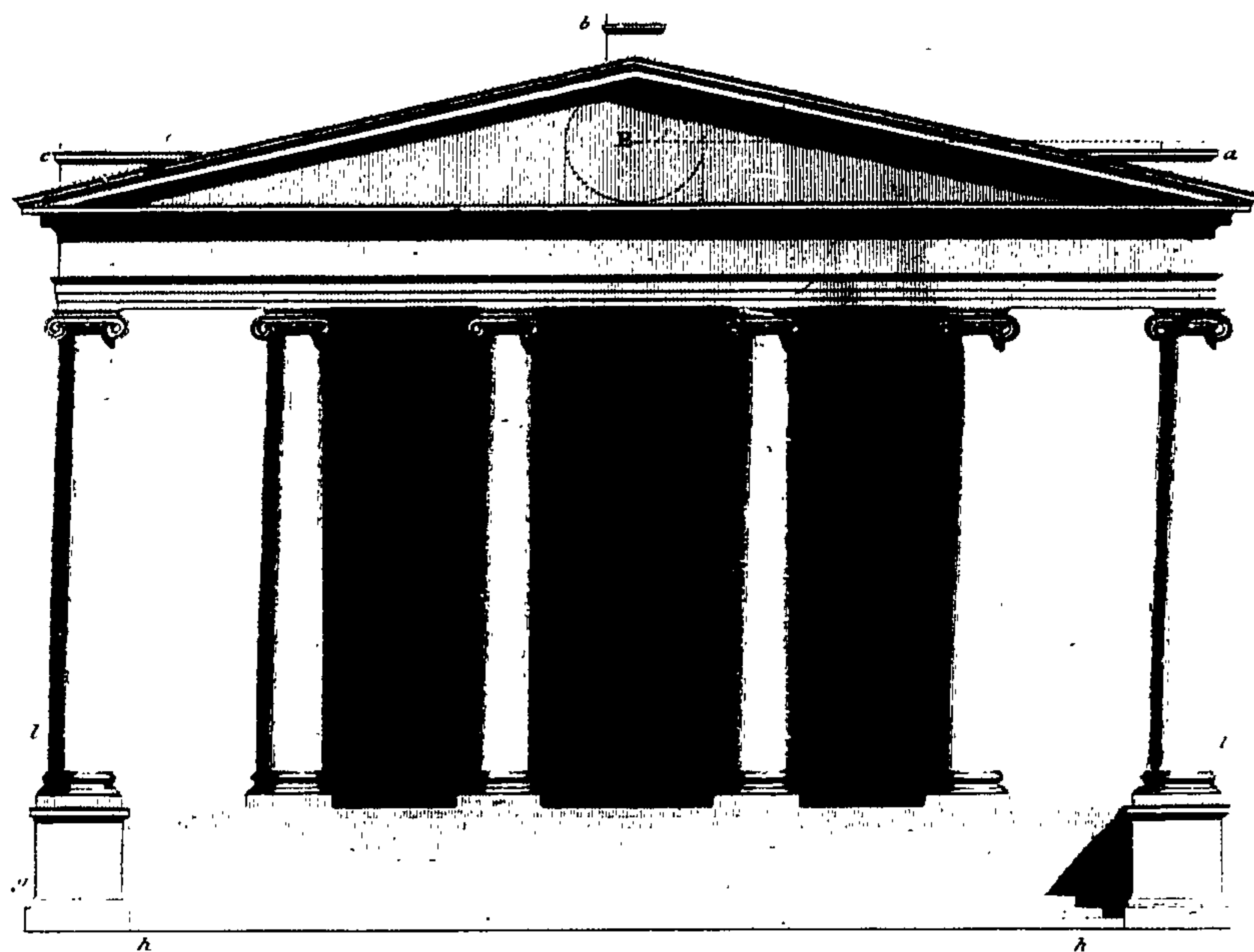
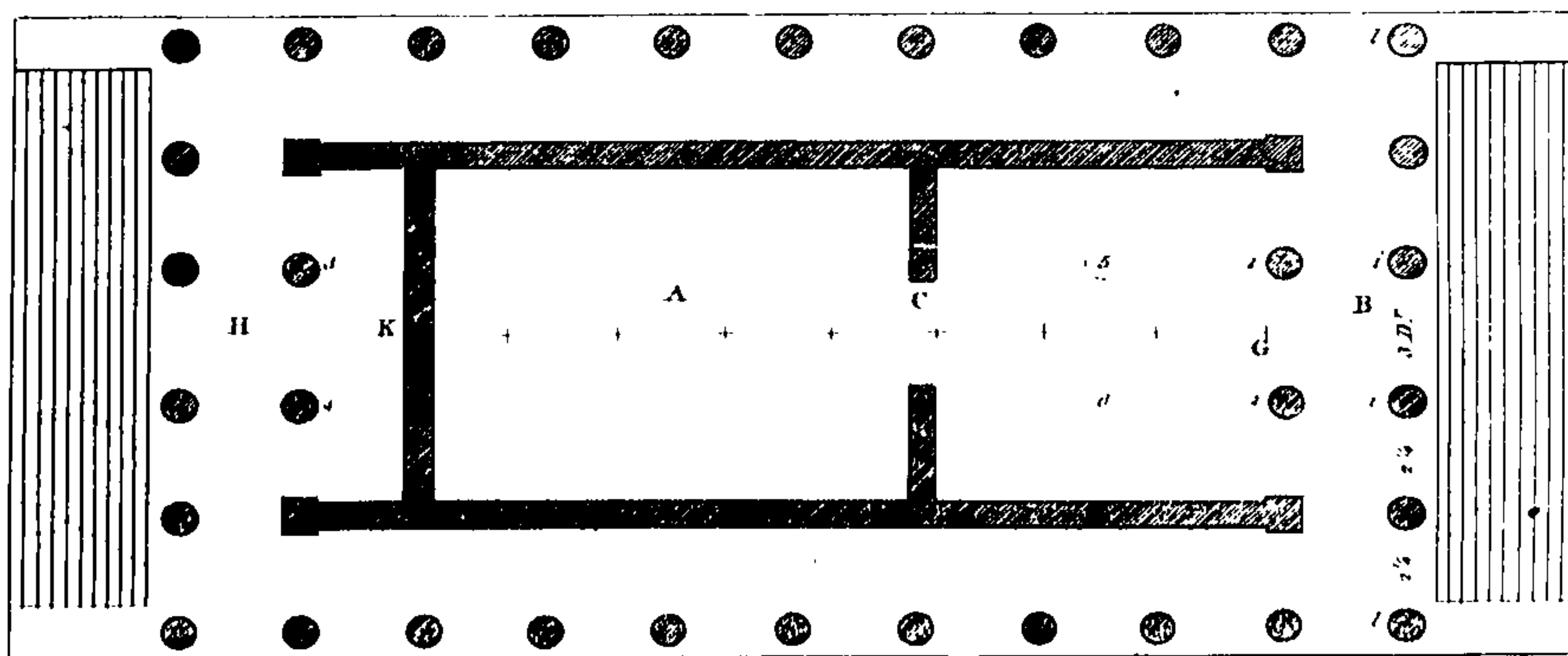


Fig XVIII.
peripteros. Eustylos. Hexastylos



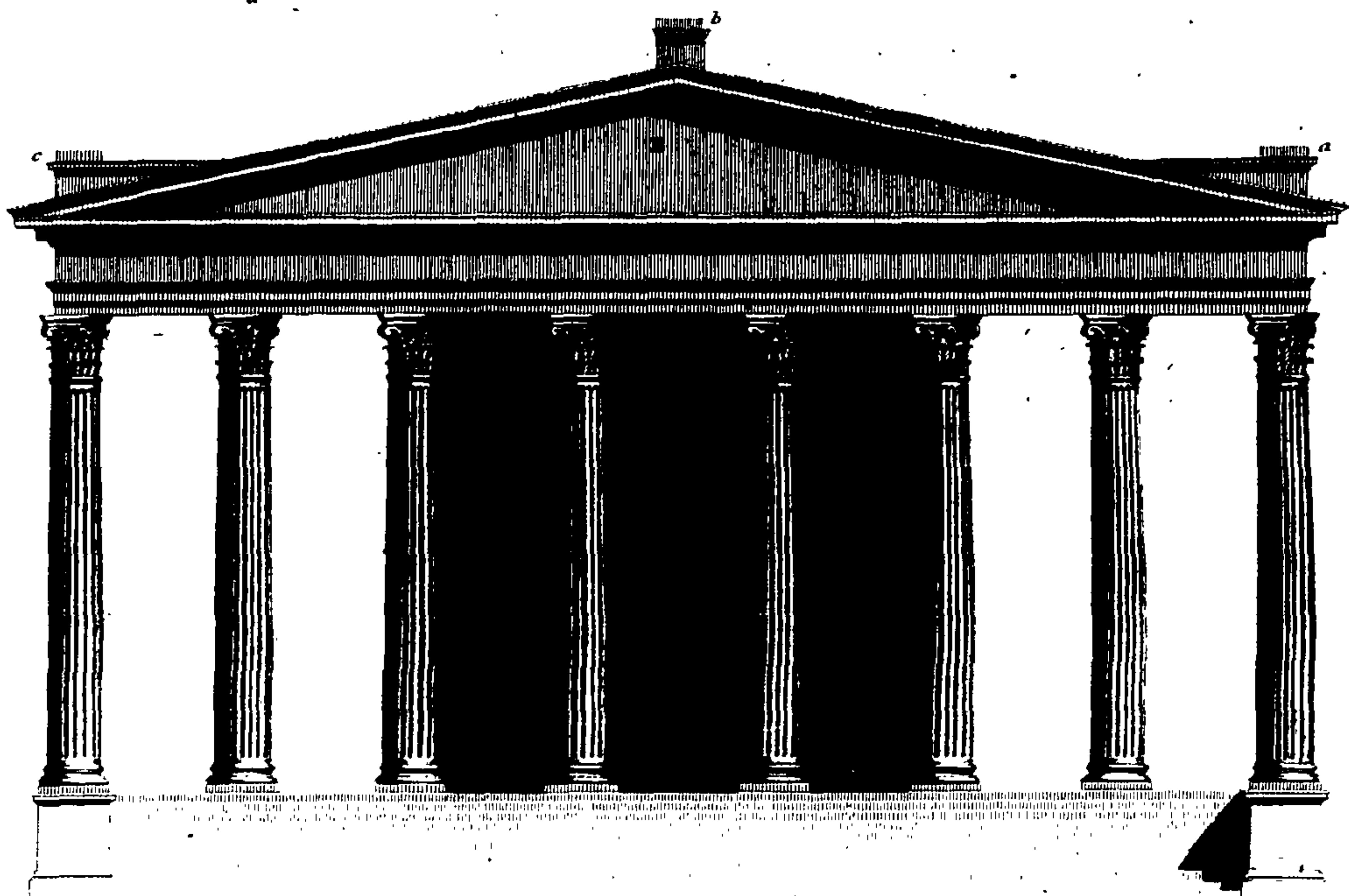


Fig. XIX.
Pseudo dipteros. Systylos. Octastylos

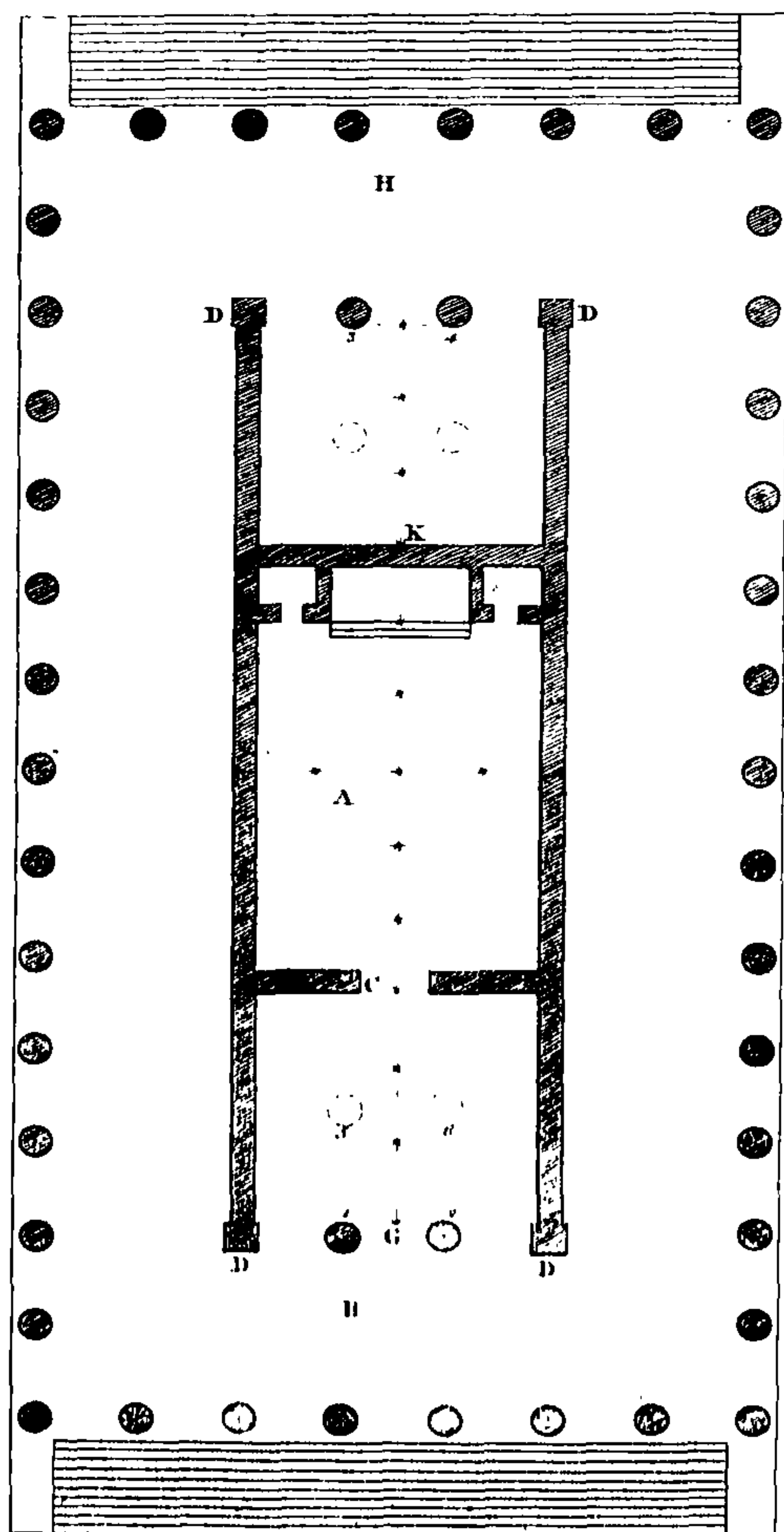
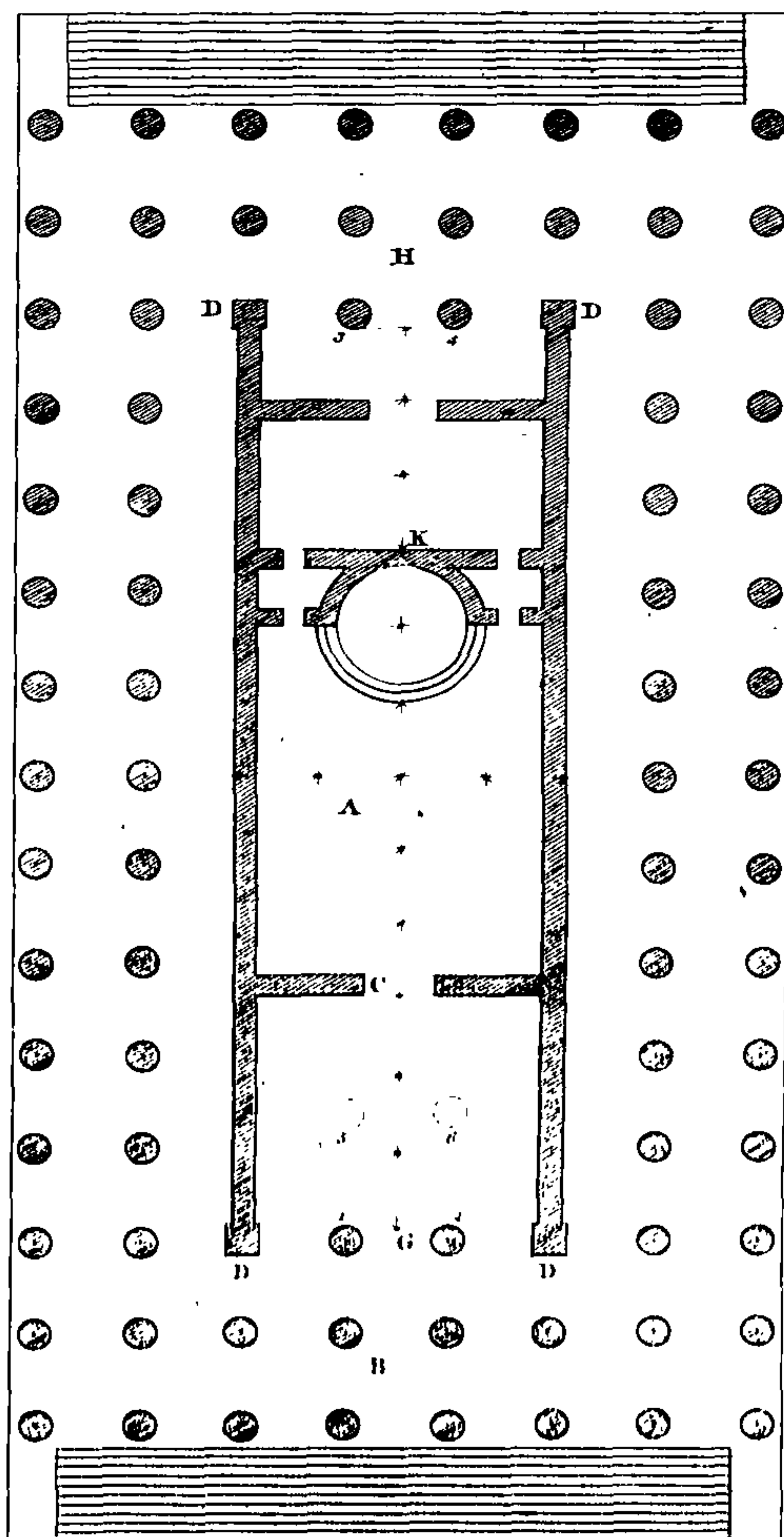


Fig. XX.
Dipteros. Systylos. Octastylos



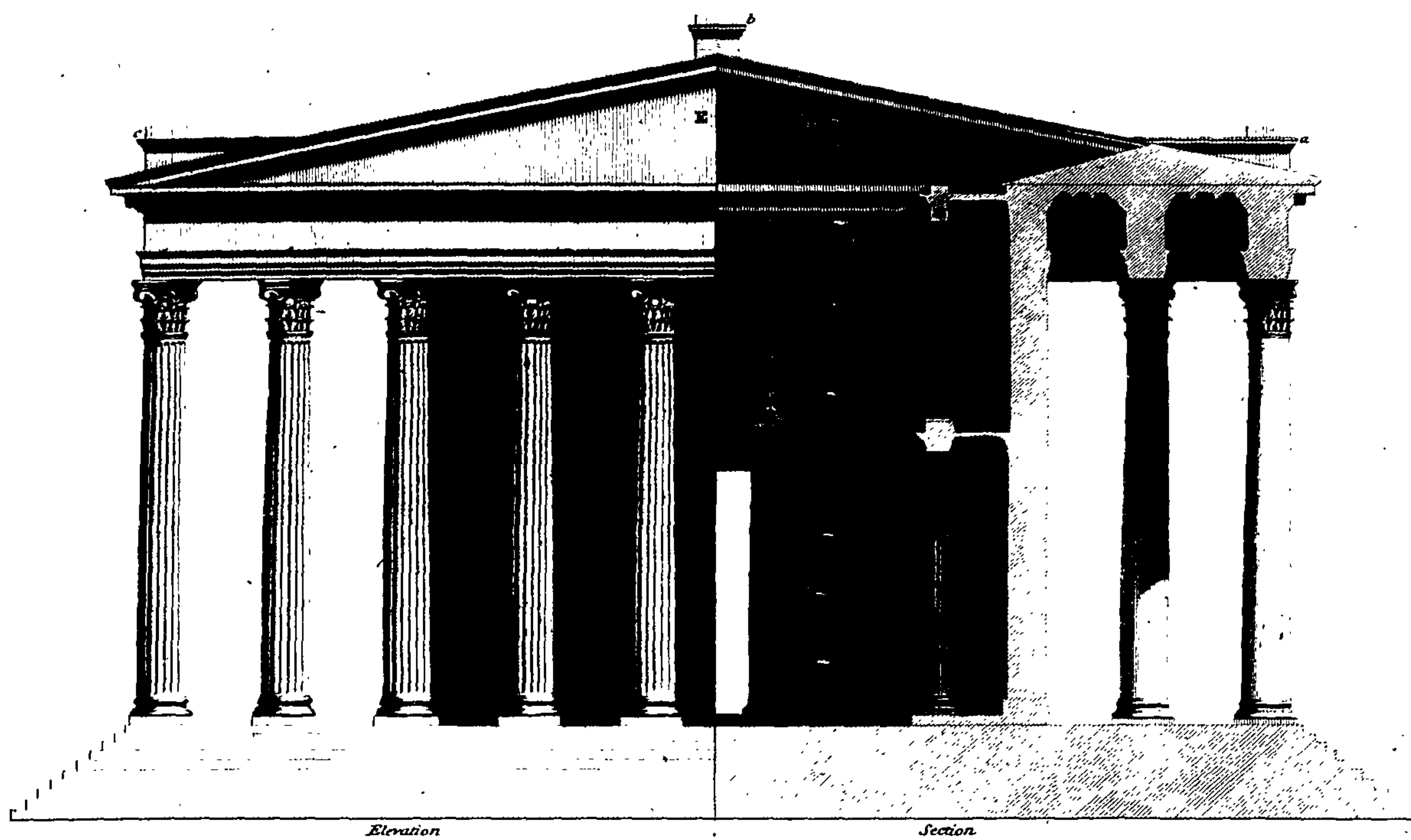
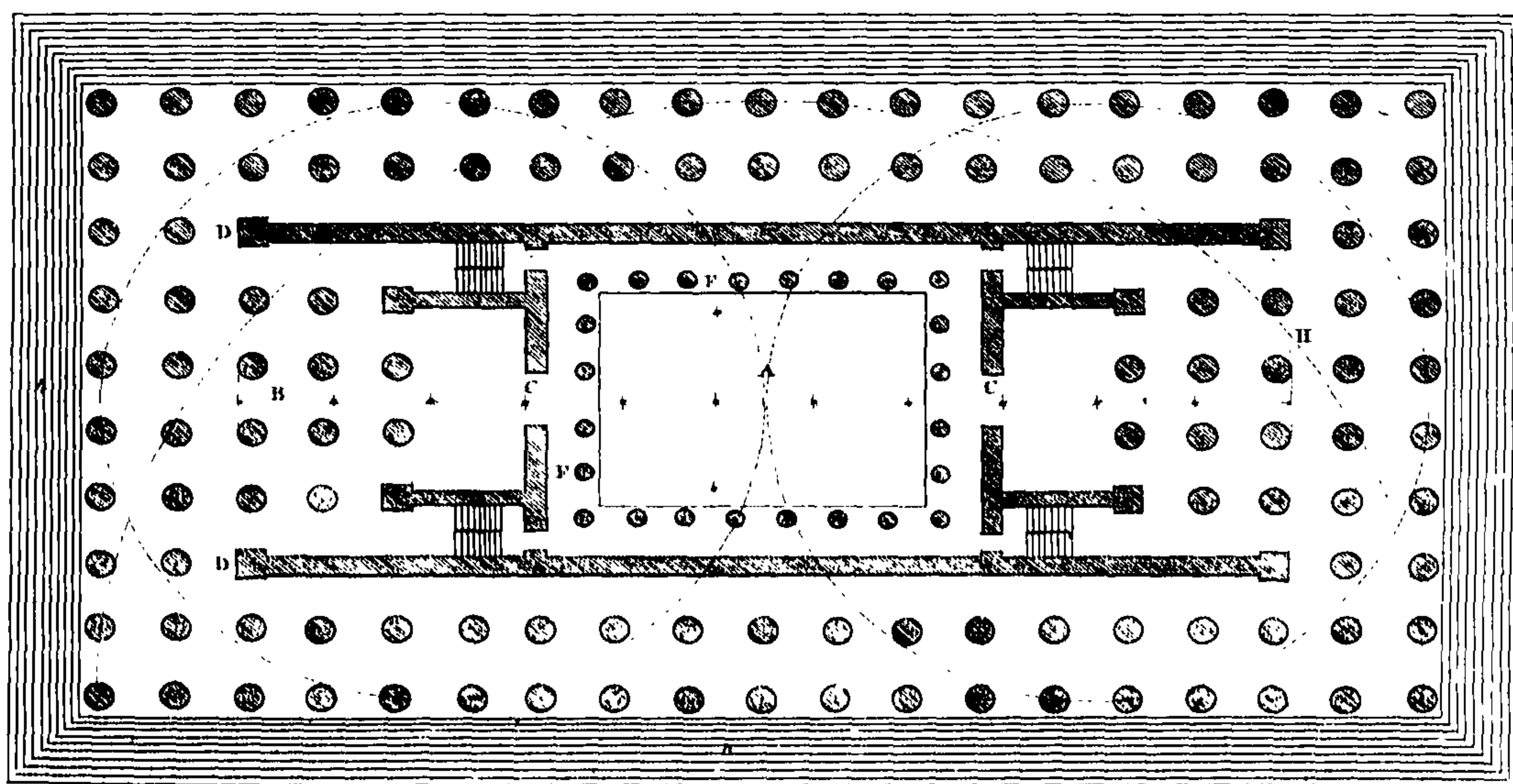


Fig. XXI.

Hypæthros. Ptenostylos. Decastylos.



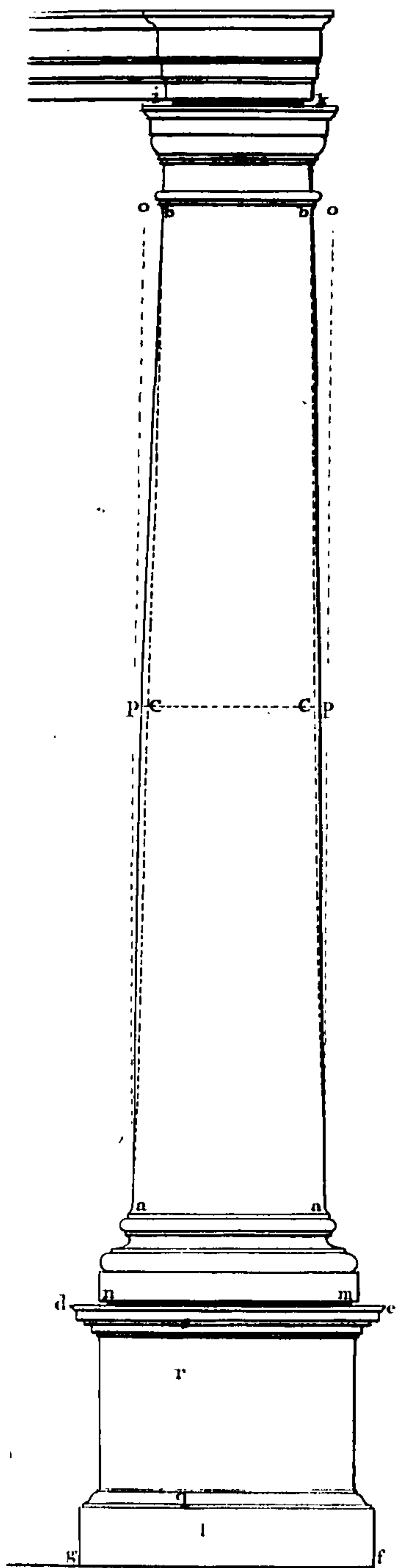
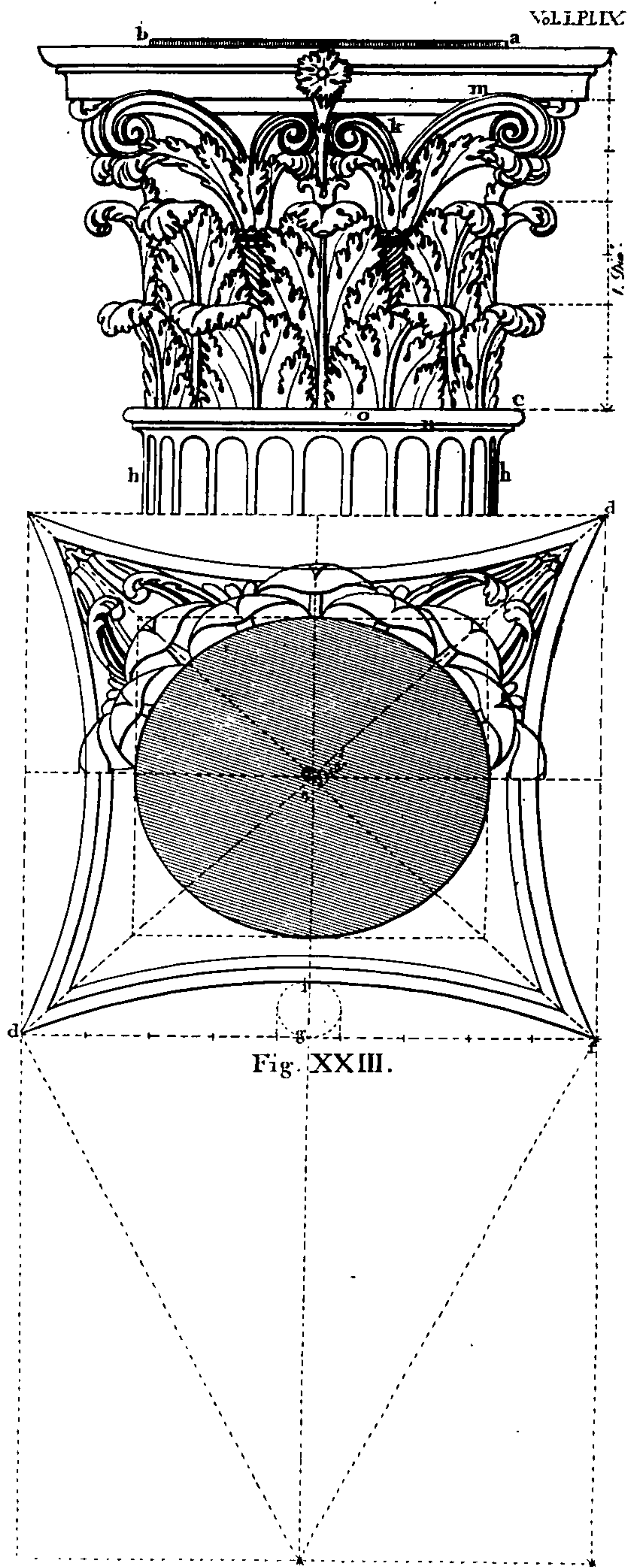
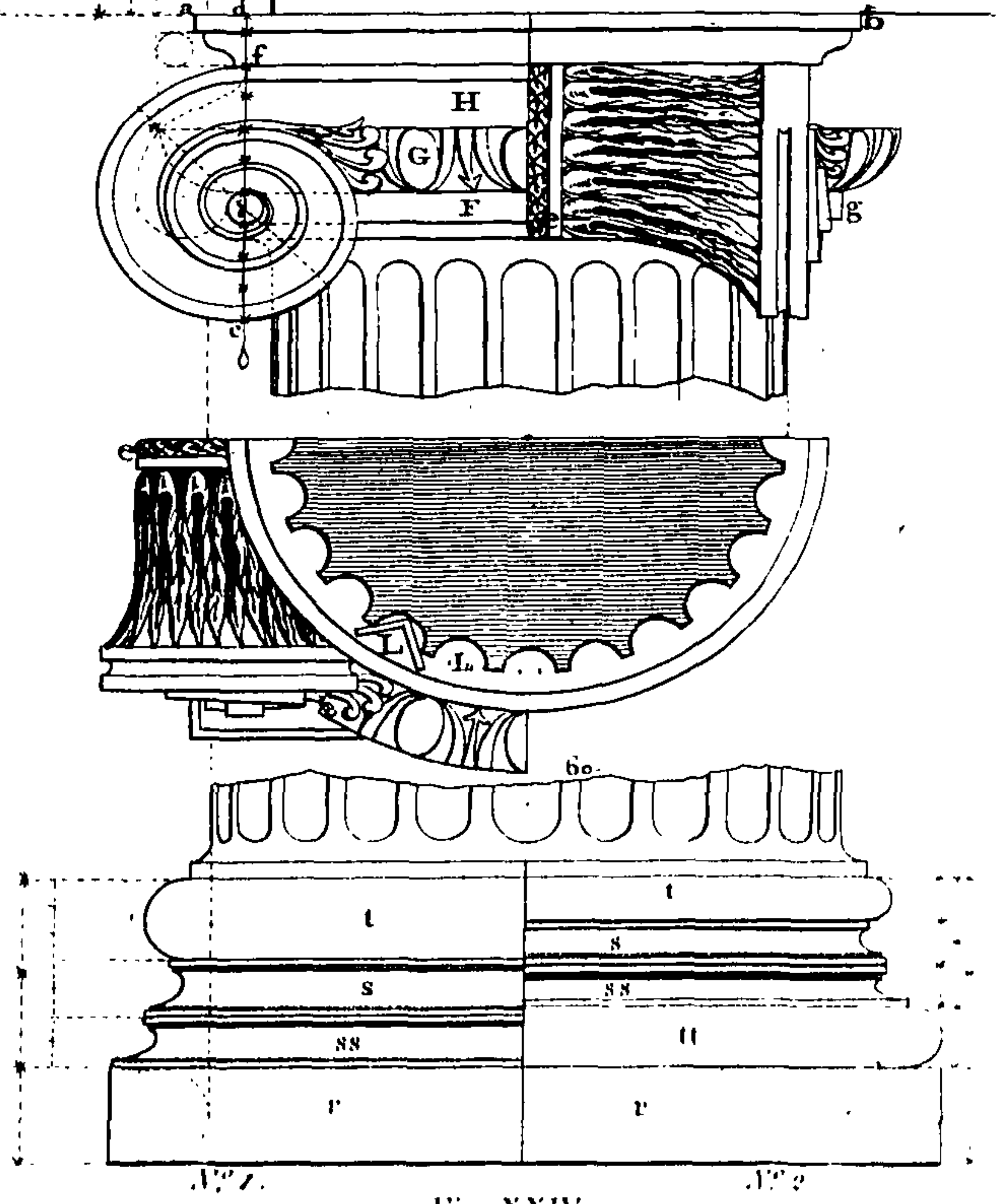
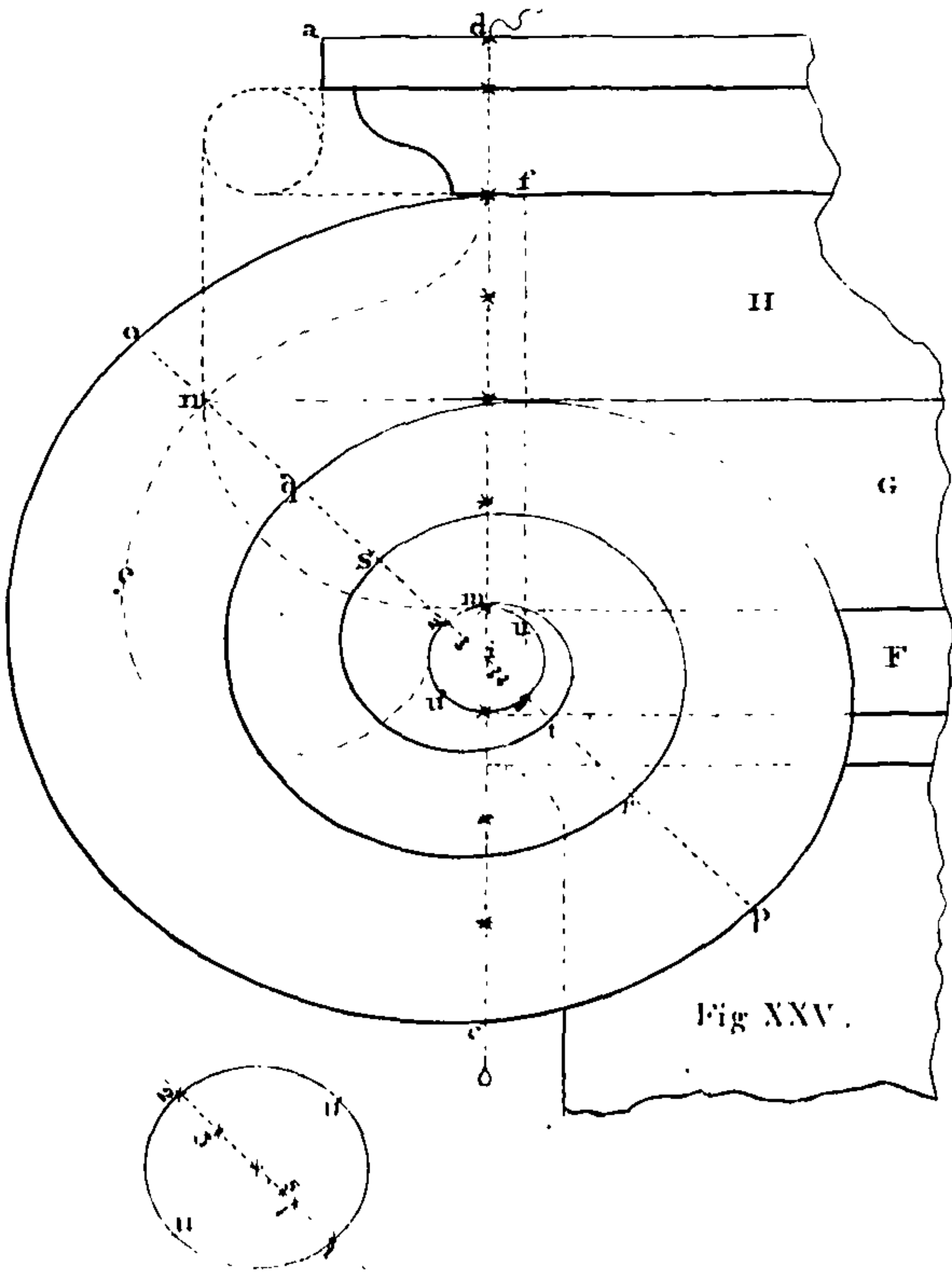
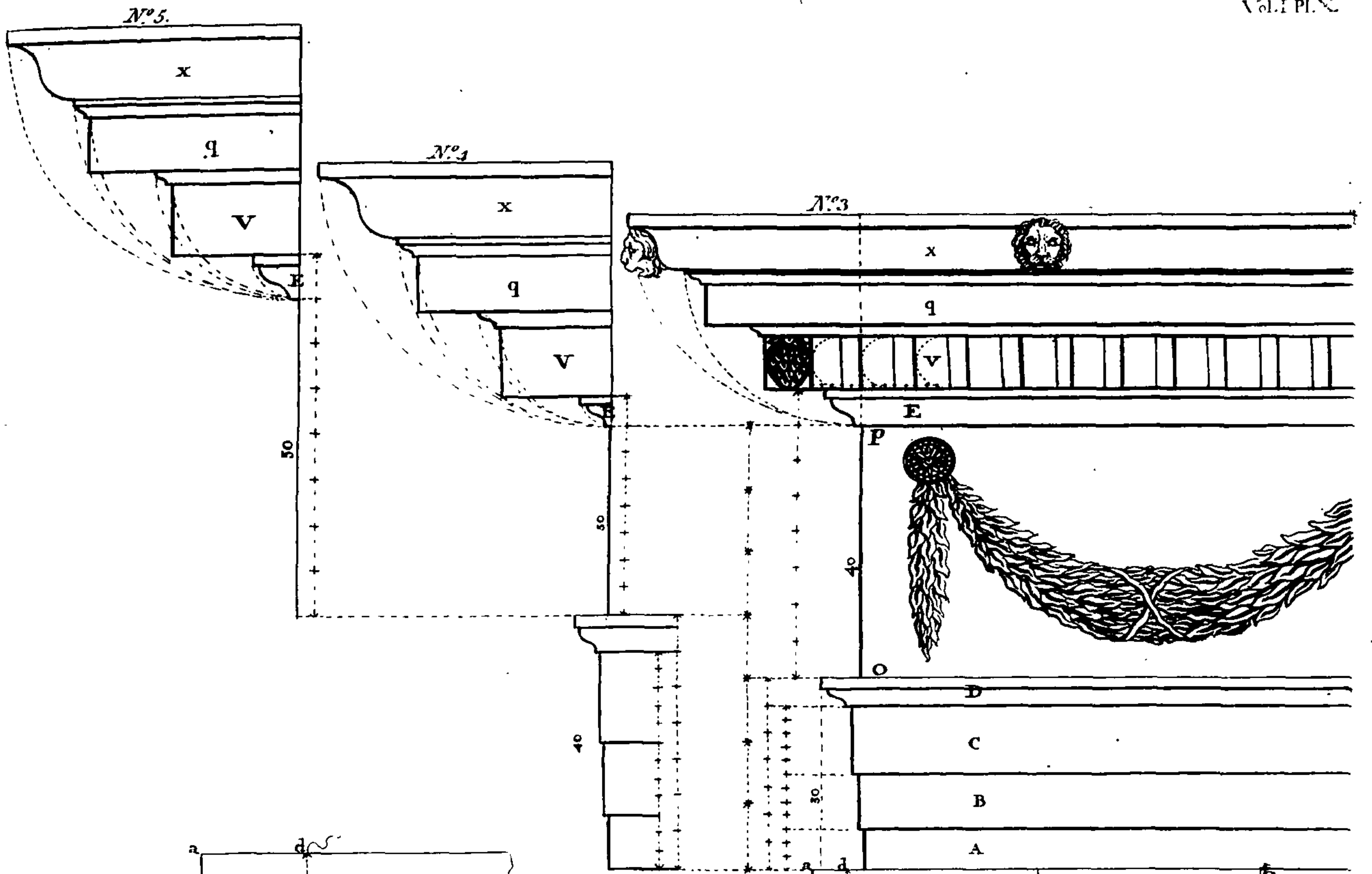


Fig. XXII.





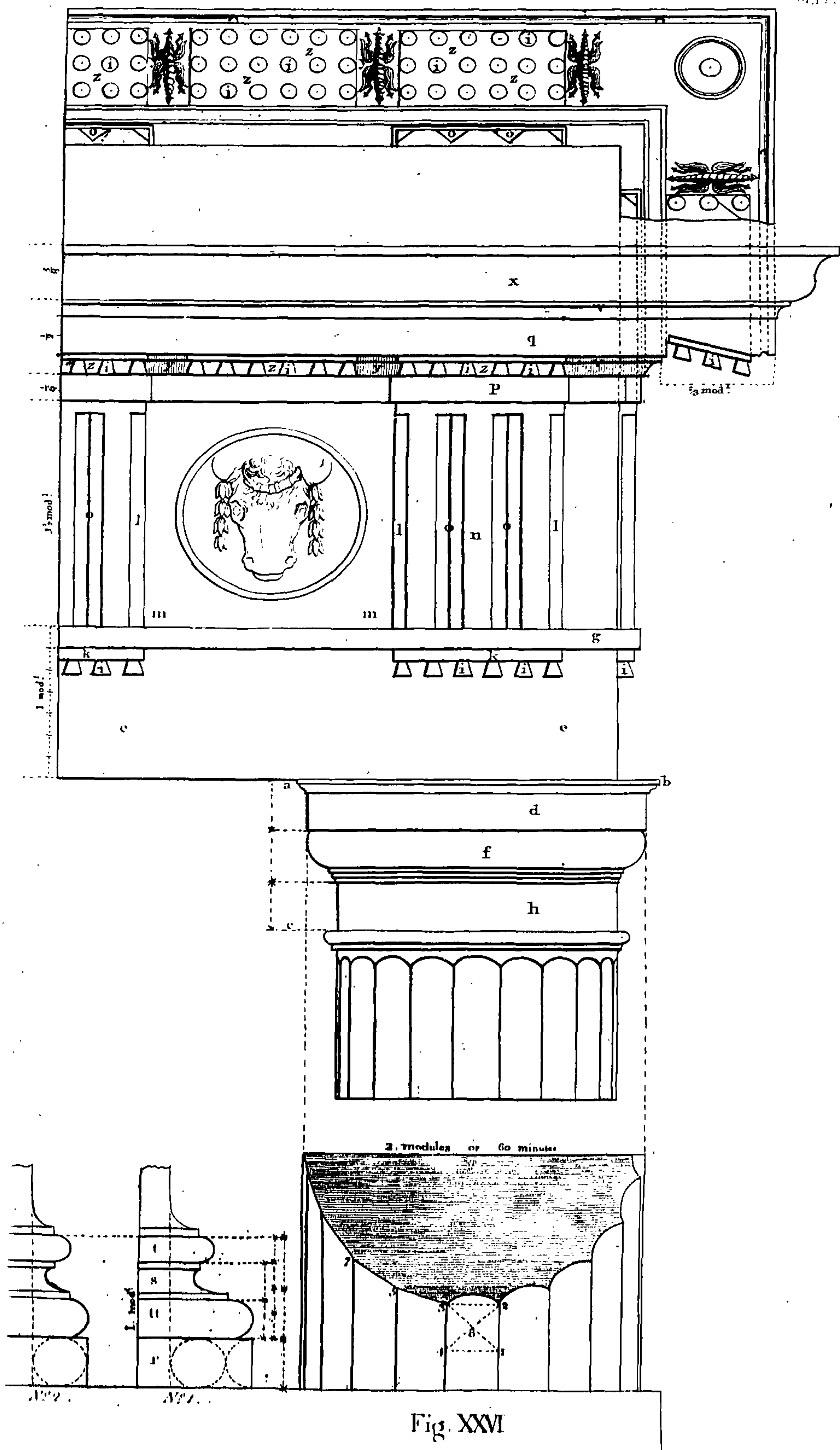


Fig. XXVI

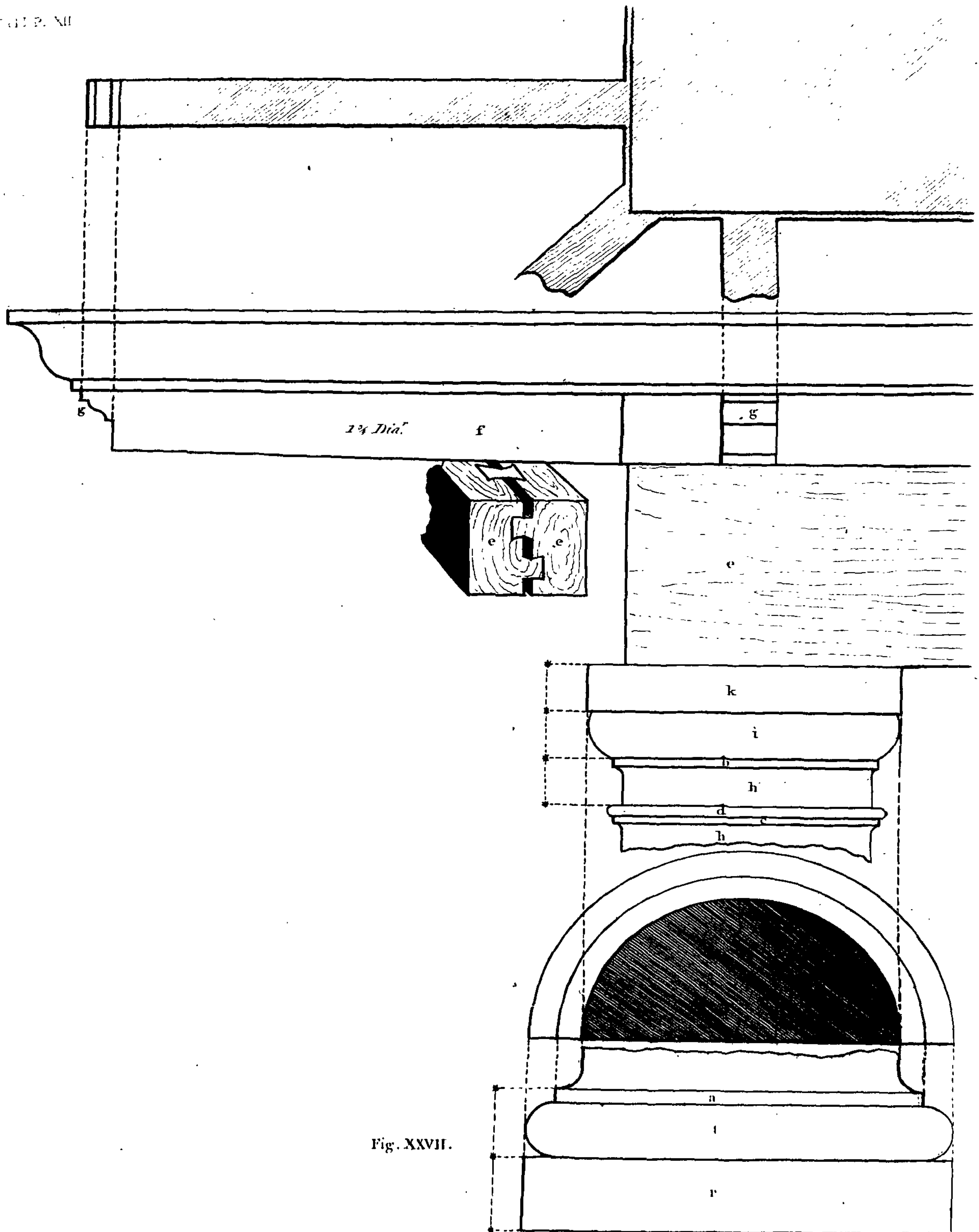


Fig. XXVII.

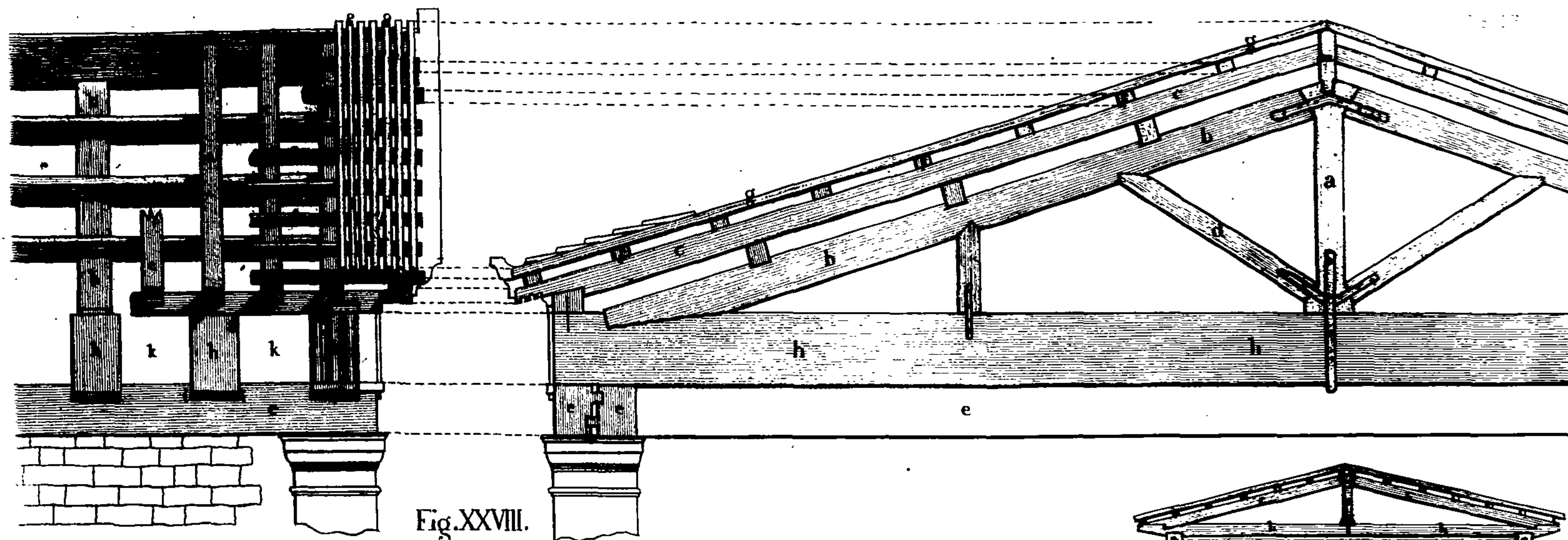


Fig.XXVIII.

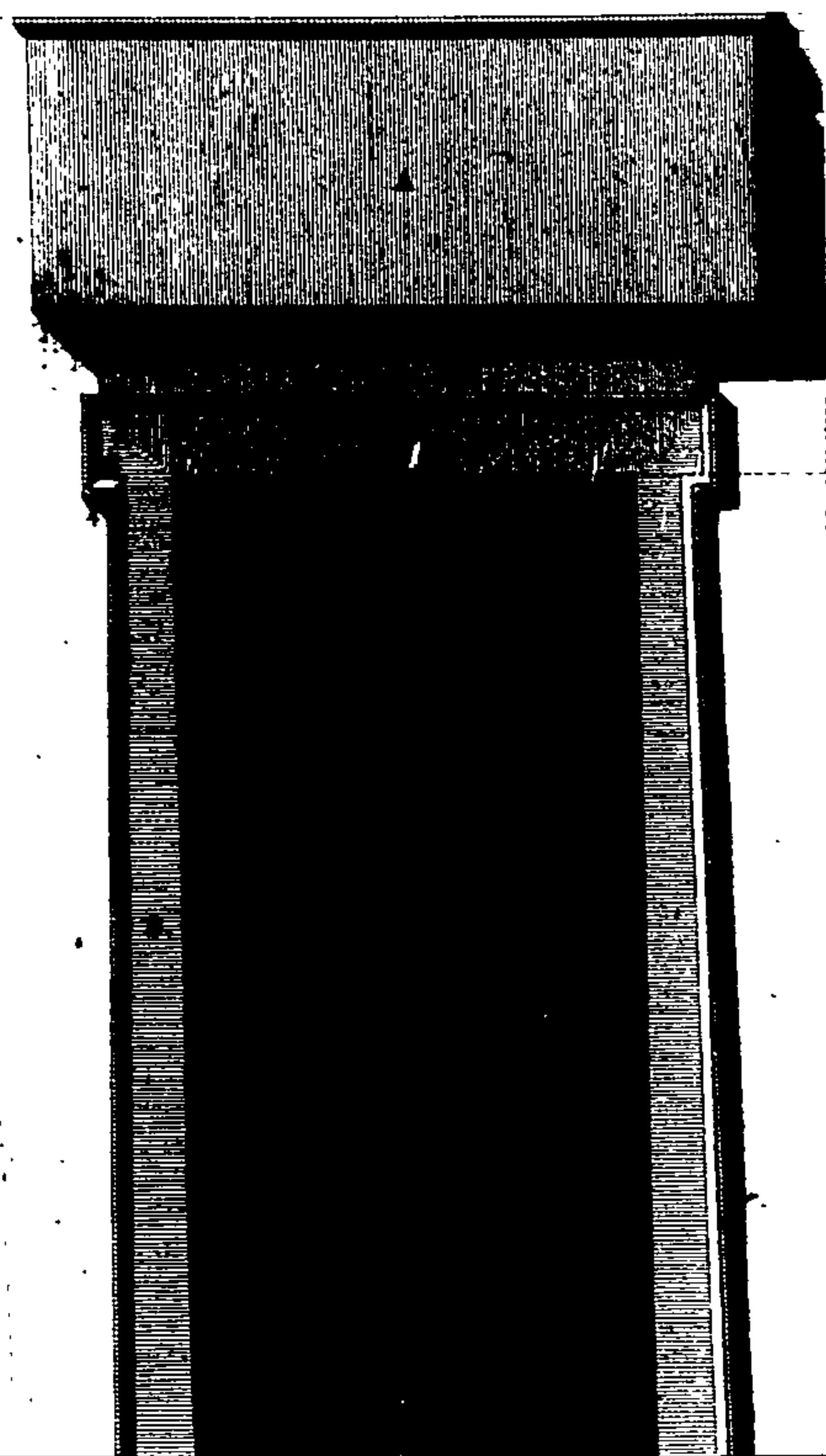


Fig. XXIX.



Fig. XXX.

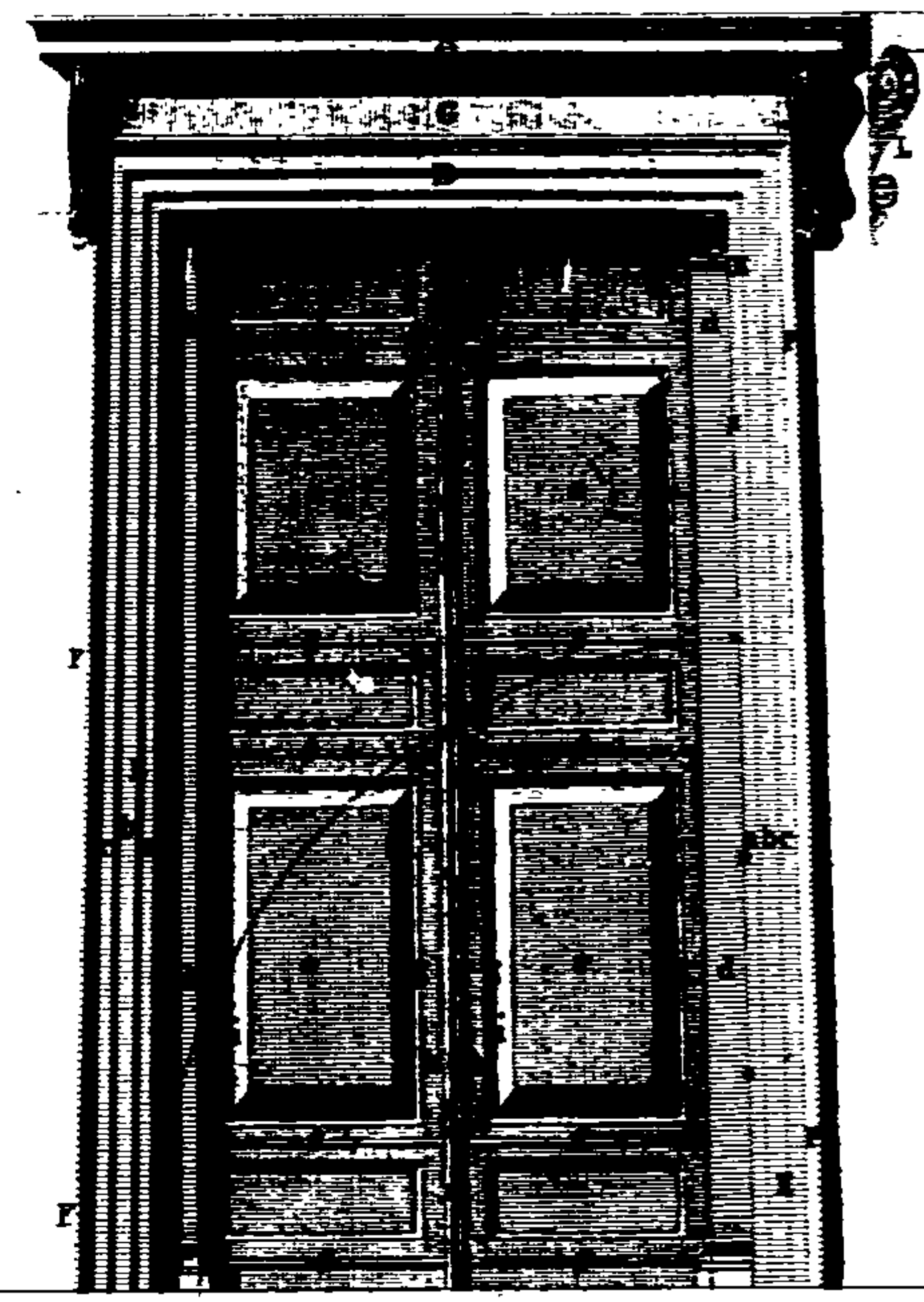


Fig. XXXI.

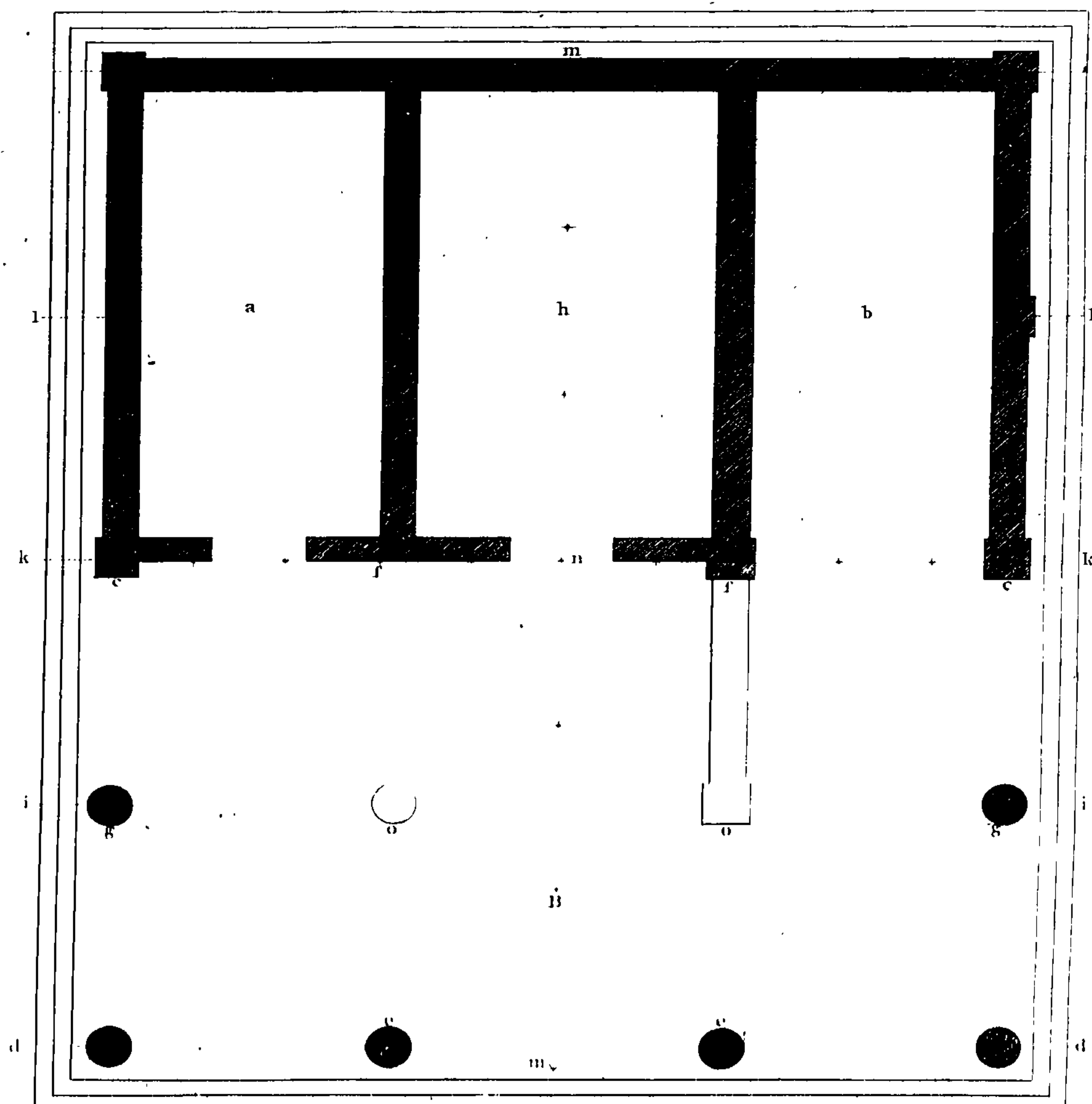
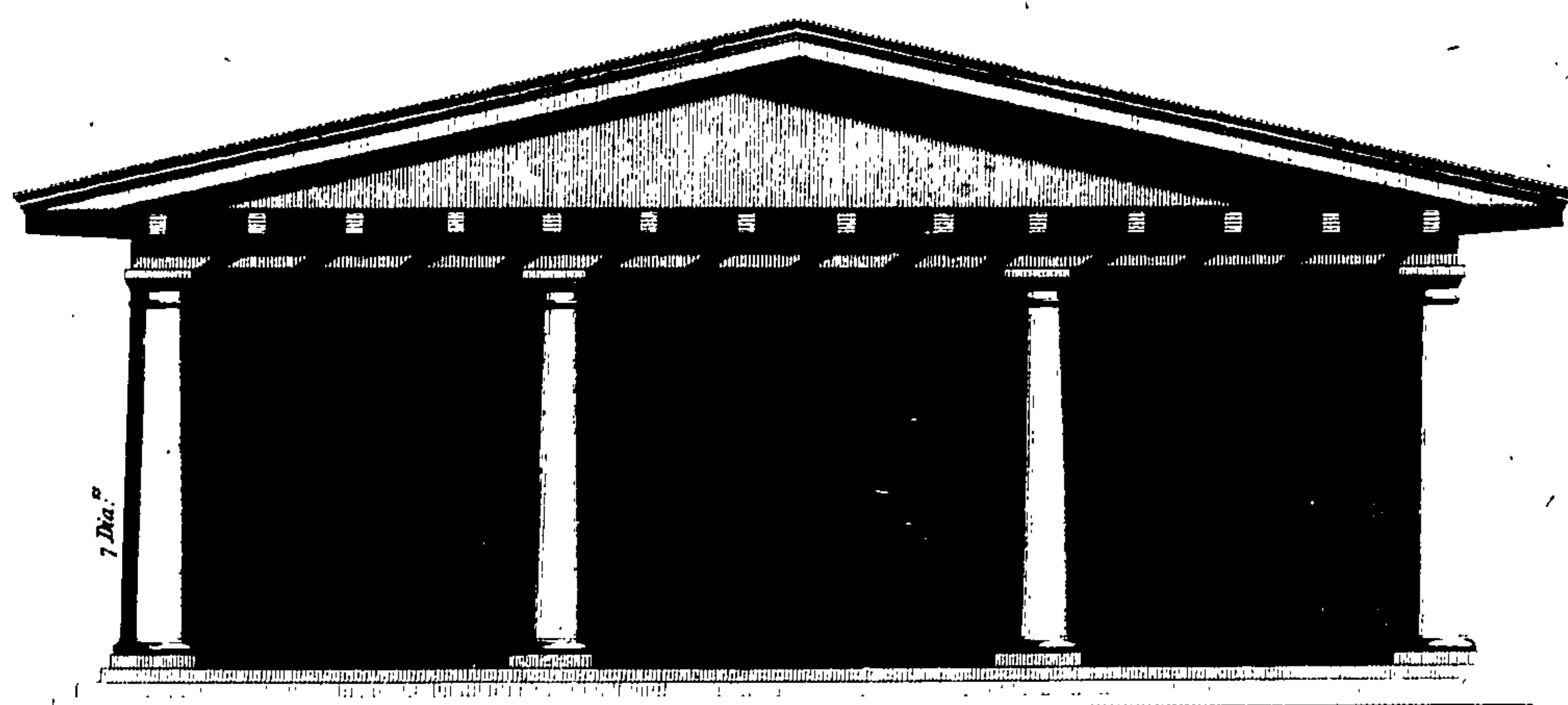


Fig. XXXII.

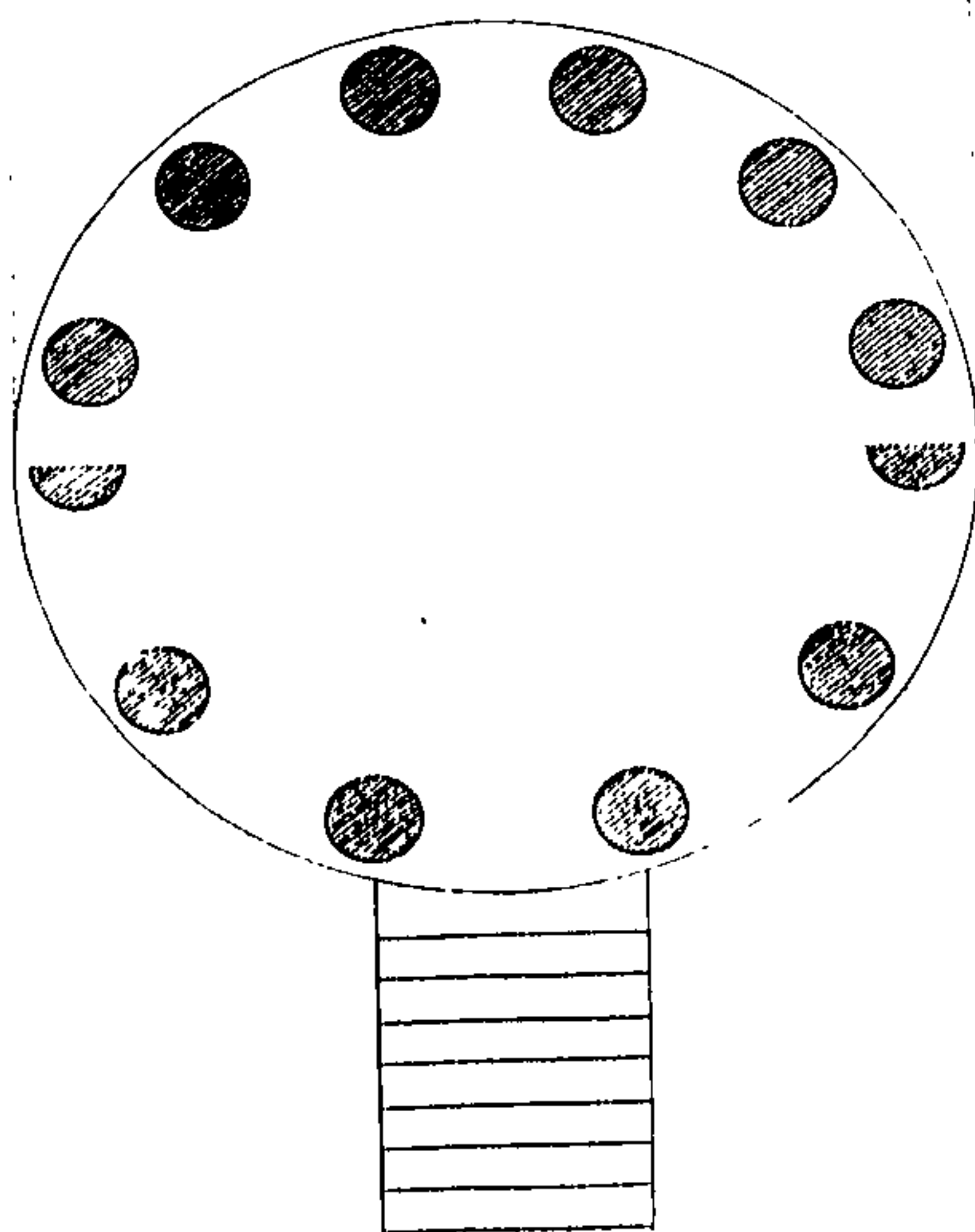
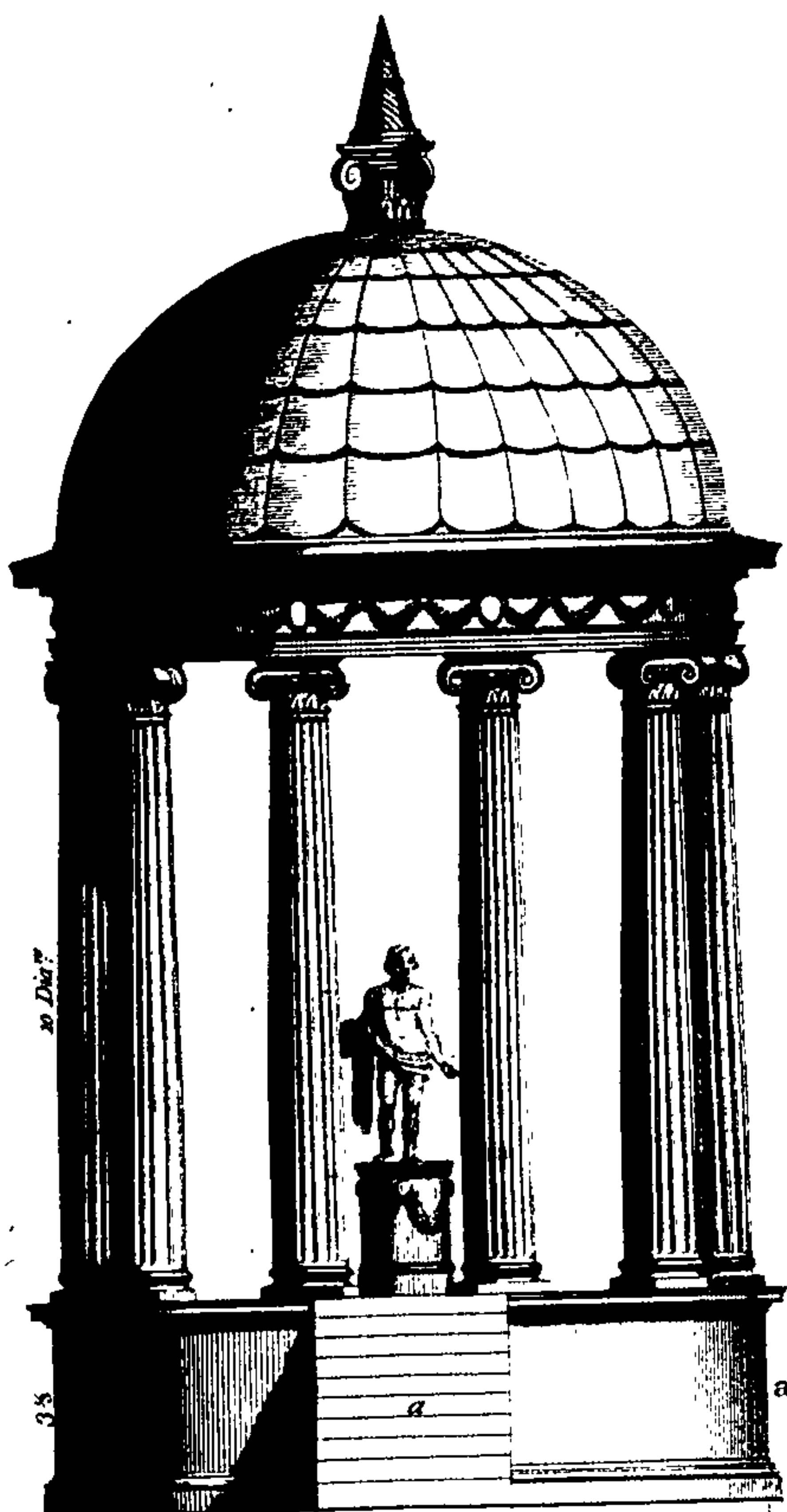


Fig. XXXIII.

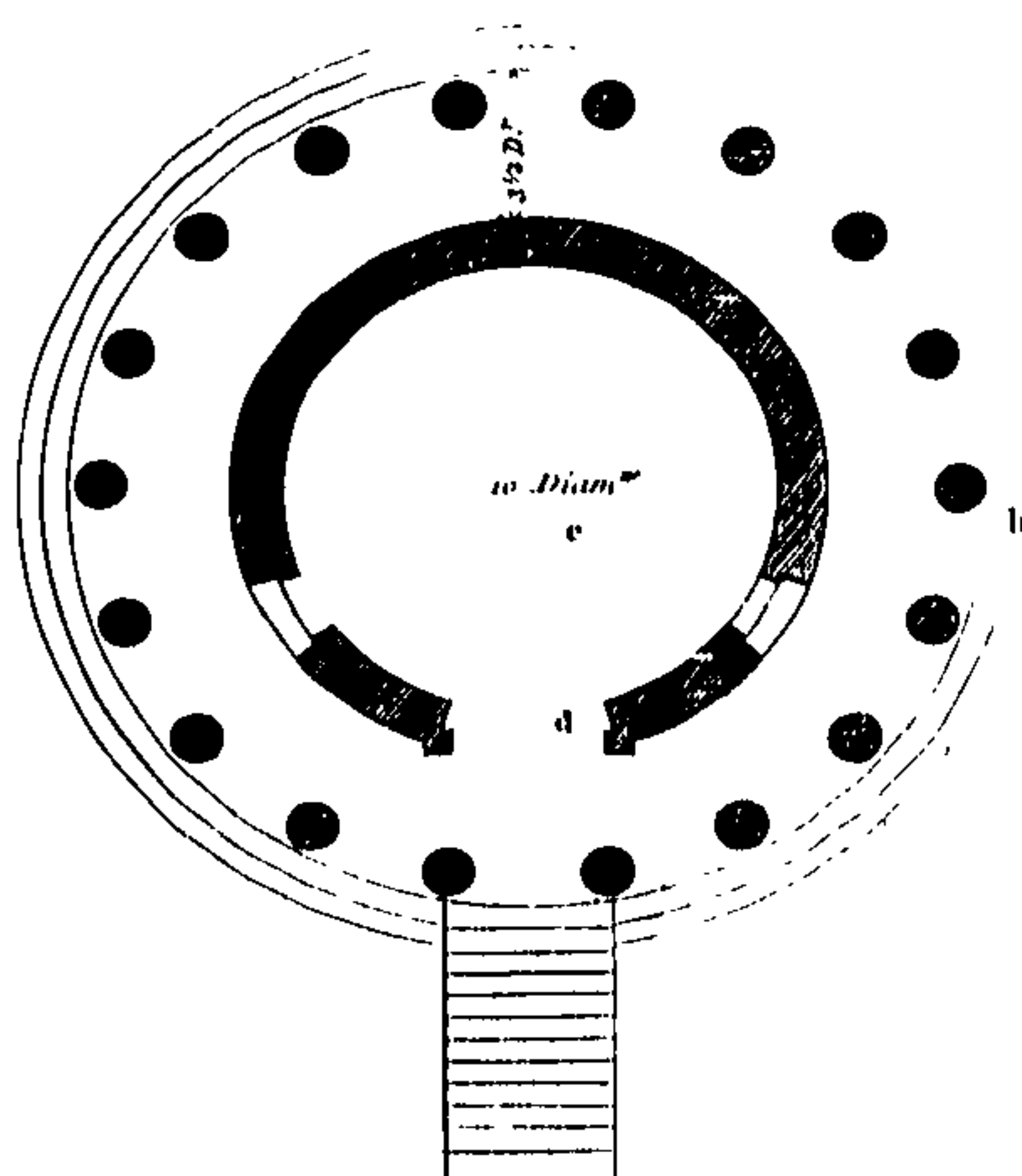
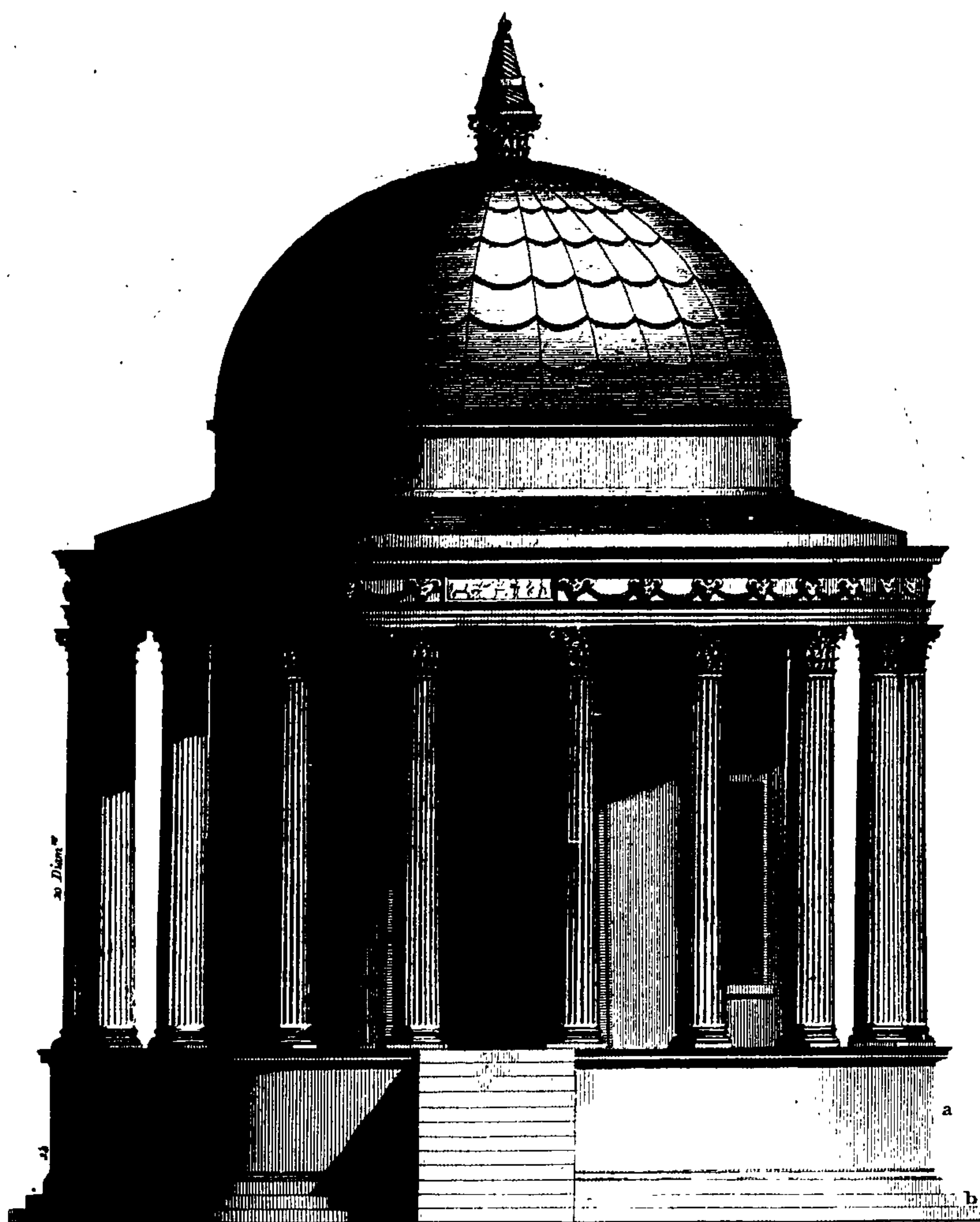


Fig XXXIV.

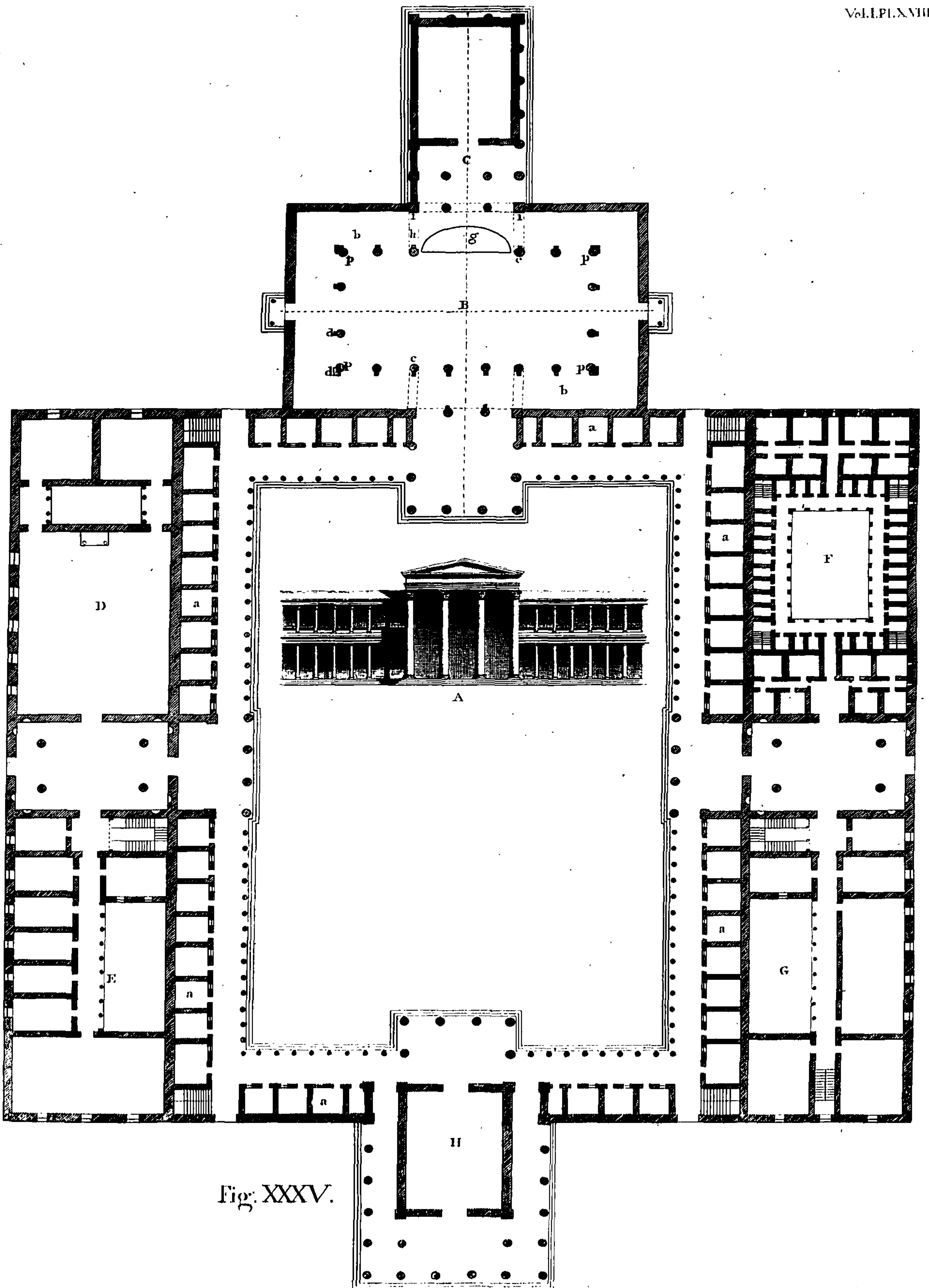


Fig. XXXV.



Fig. XXIV. N° 2.

Section of the Basilica built by VITRUVIUS at Fano.
 Coupe de la Basilique bâtie par VITRUVÉ à Fano.

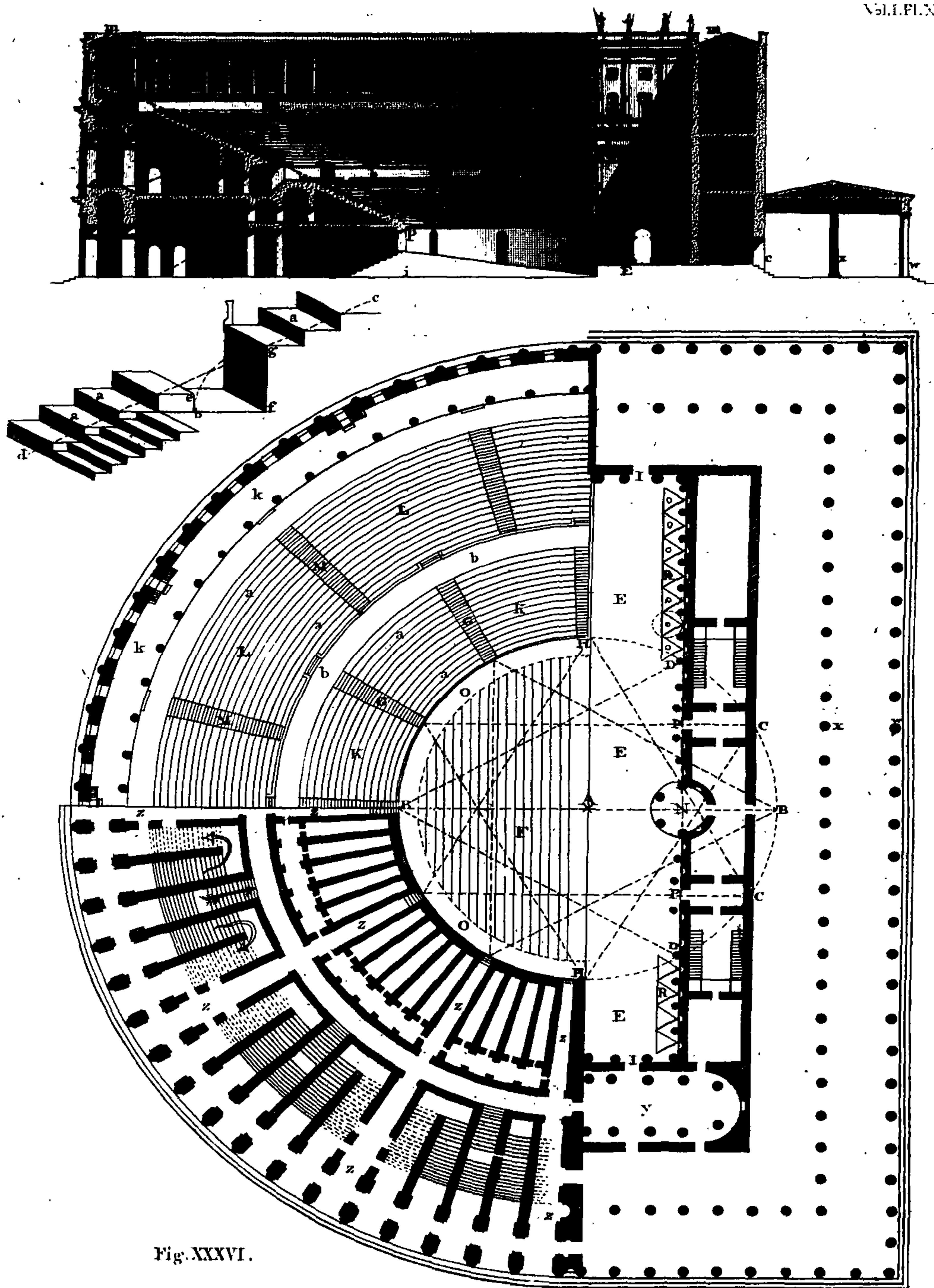
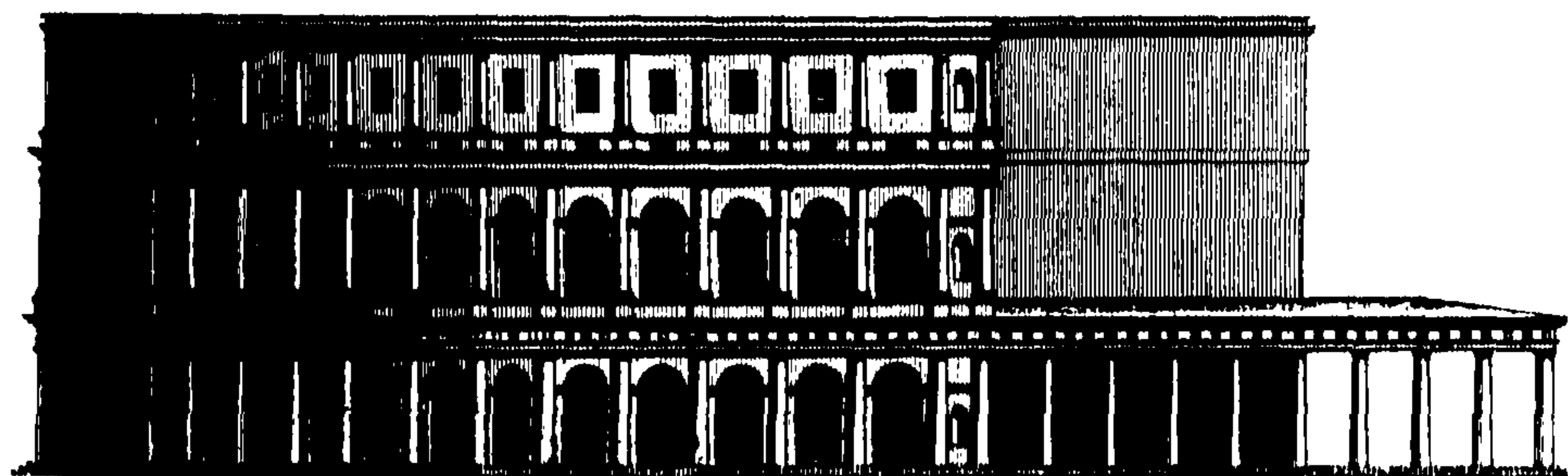


Fig. XXXVI.



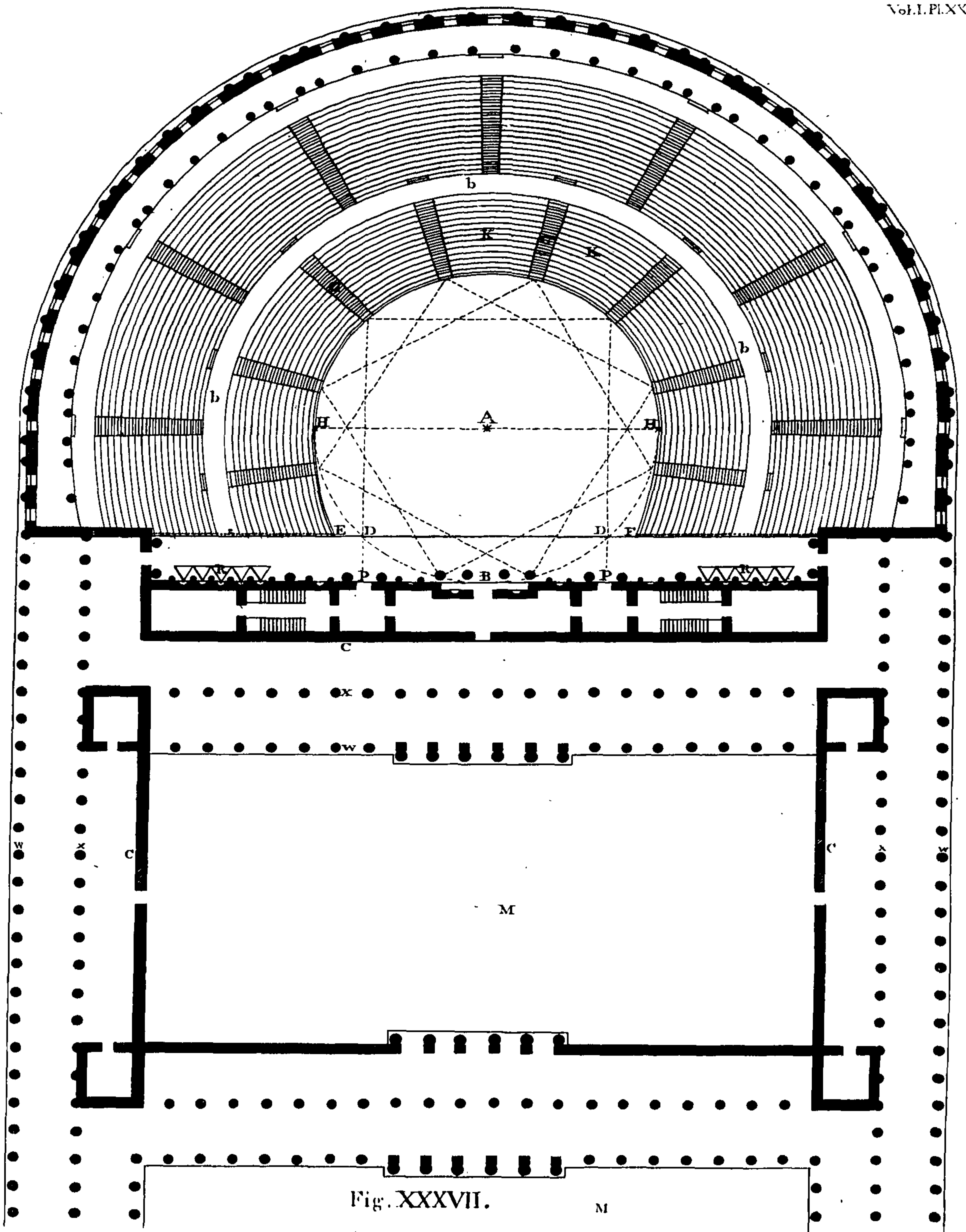


Fig. XXXVII.

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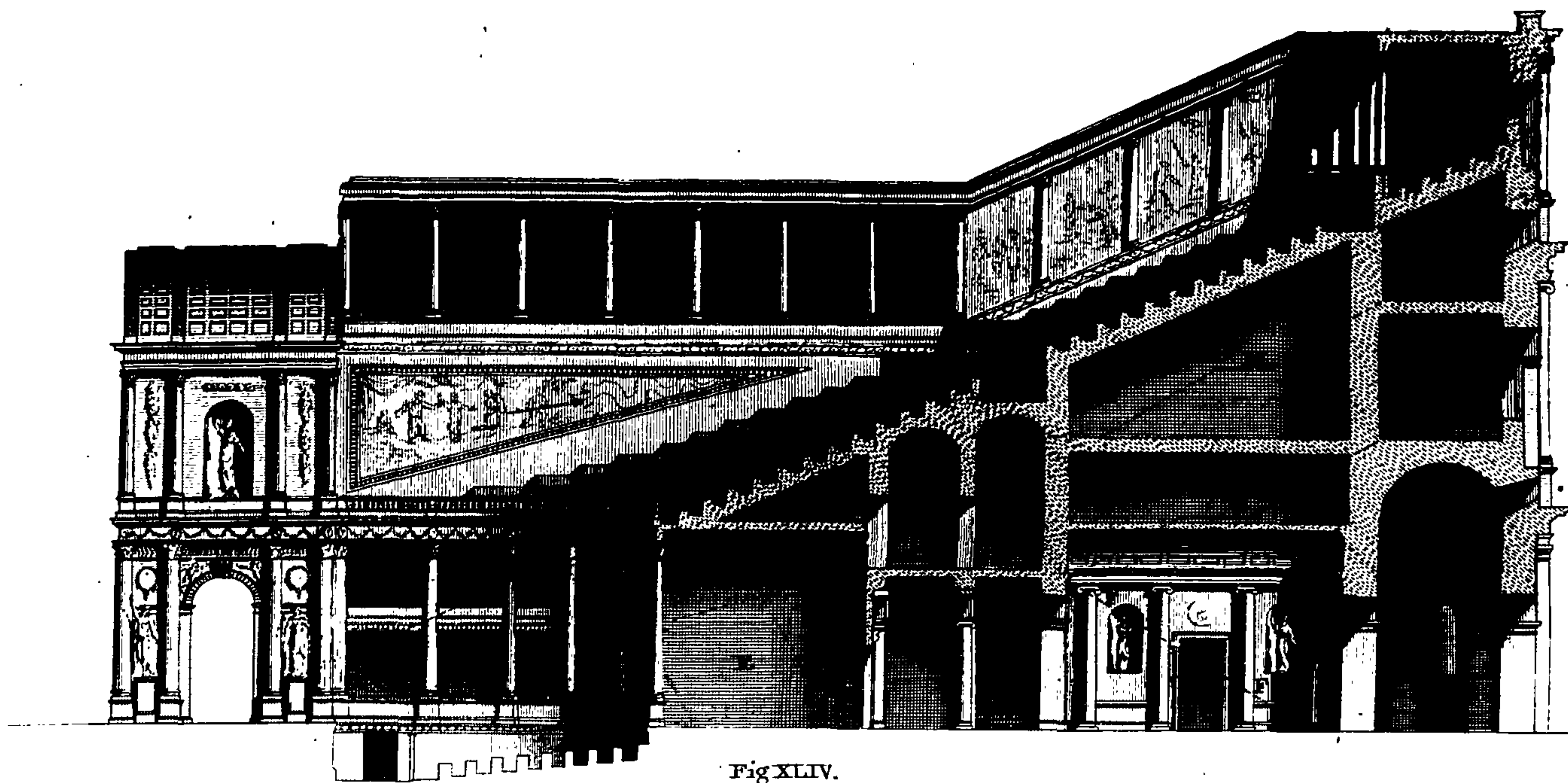


Fig XLIV.

Fig XLIII.

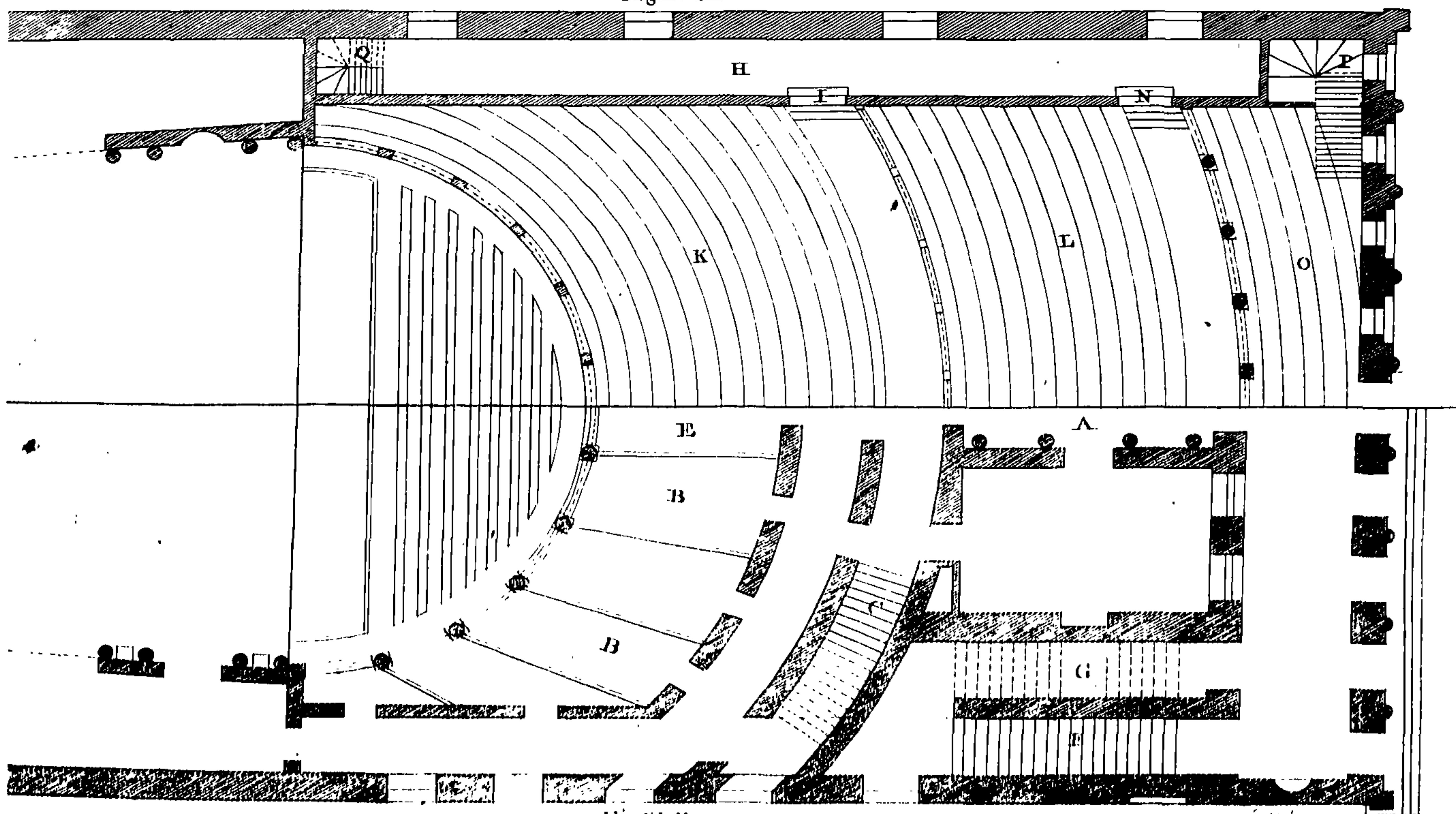


Fig XLIII.



Fig XLVI.



Fig XLVII.

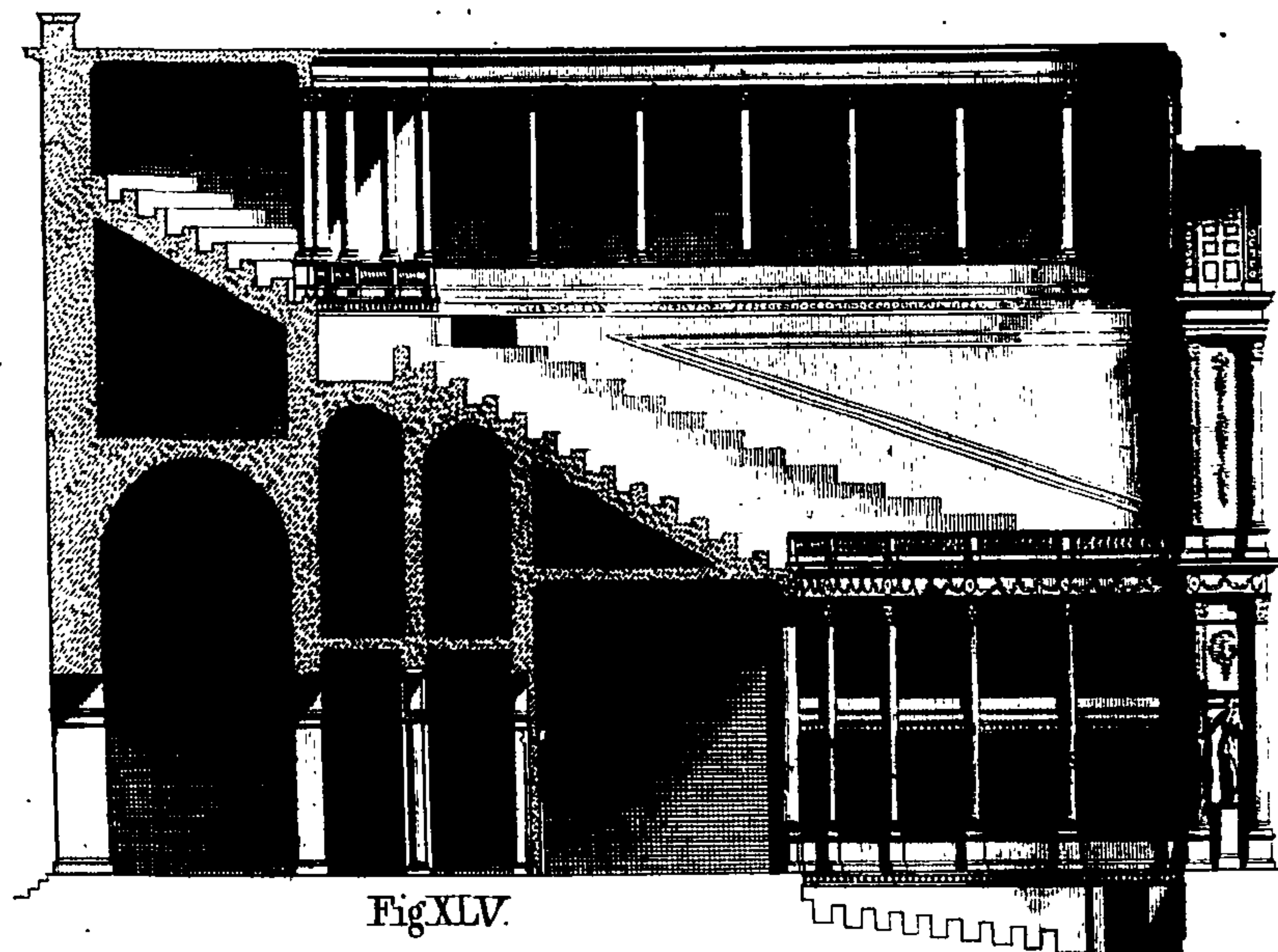


Fig XLV.



Fig. XLIX.

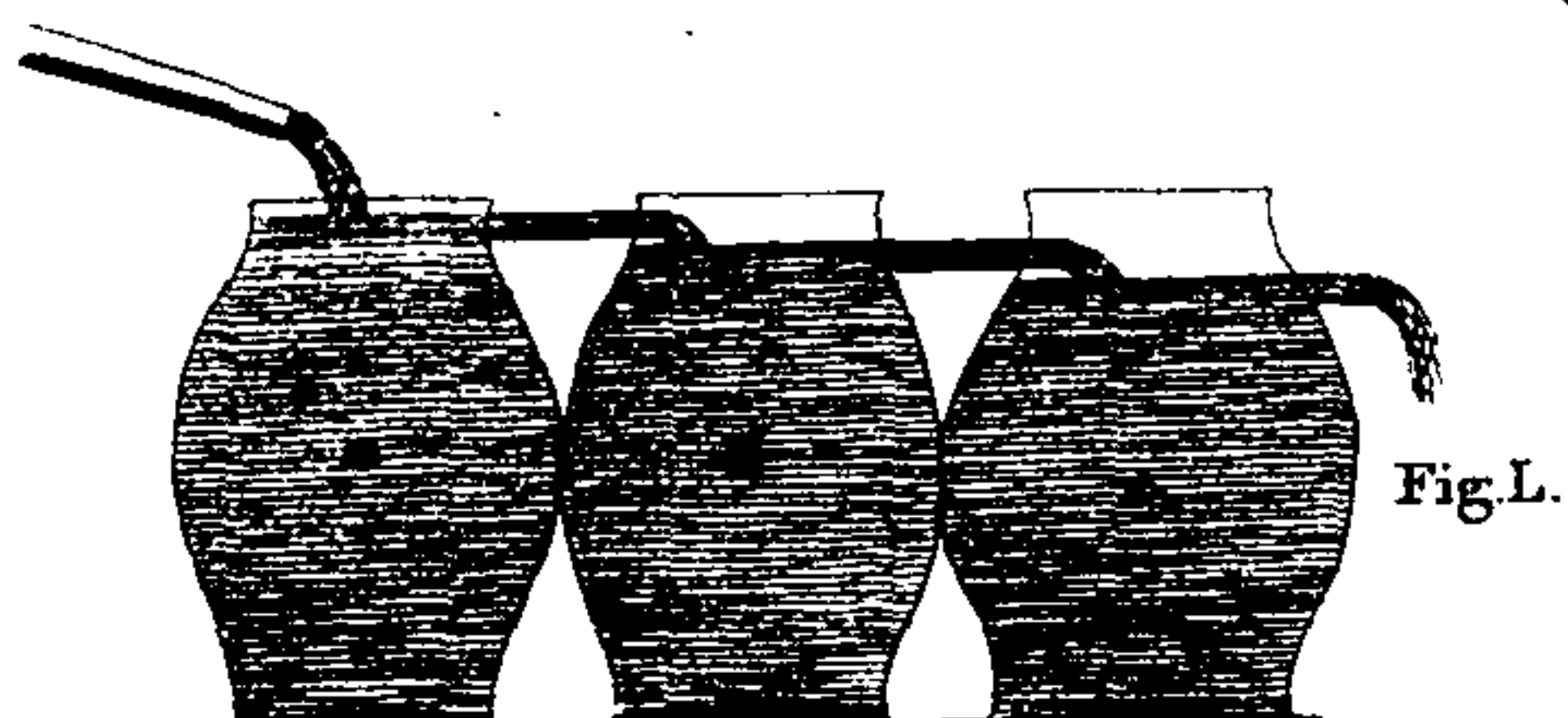


Fig. L.



Fig. LI.

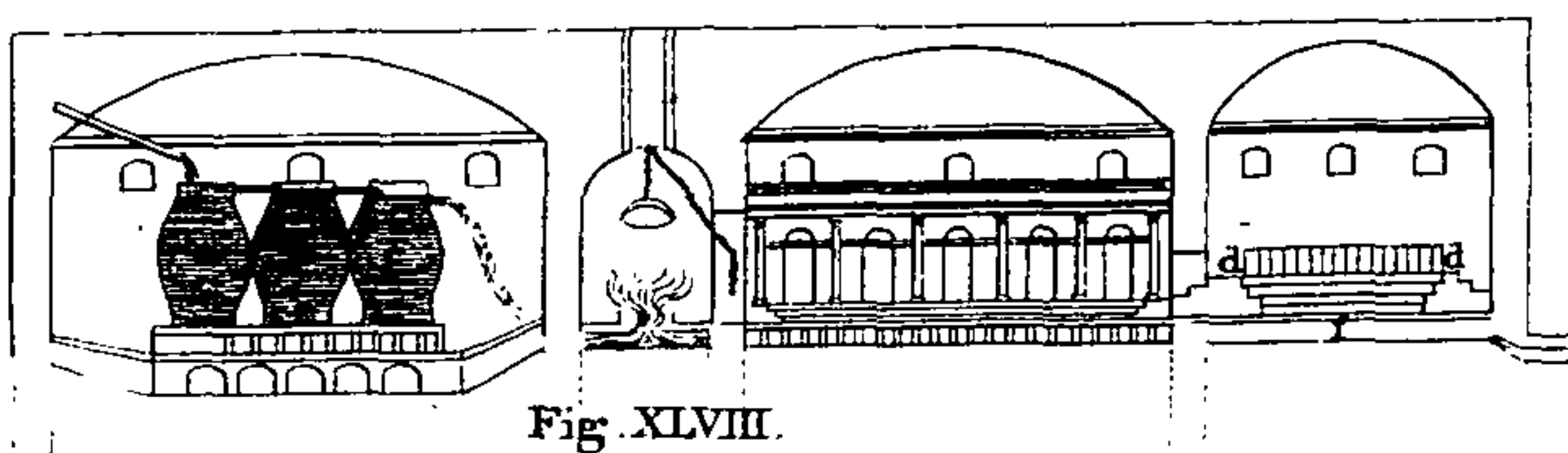
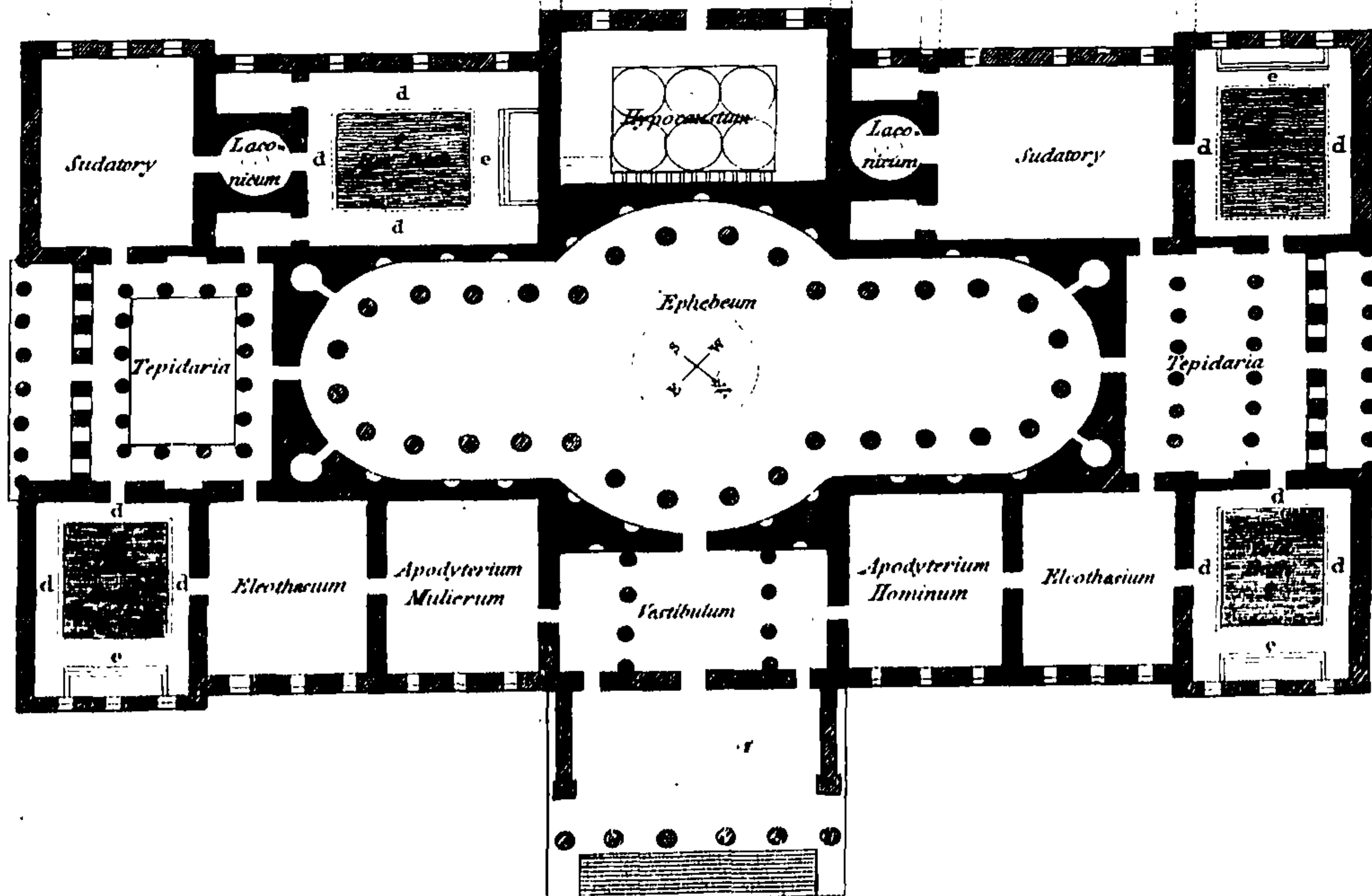


Fig. XLVIII.



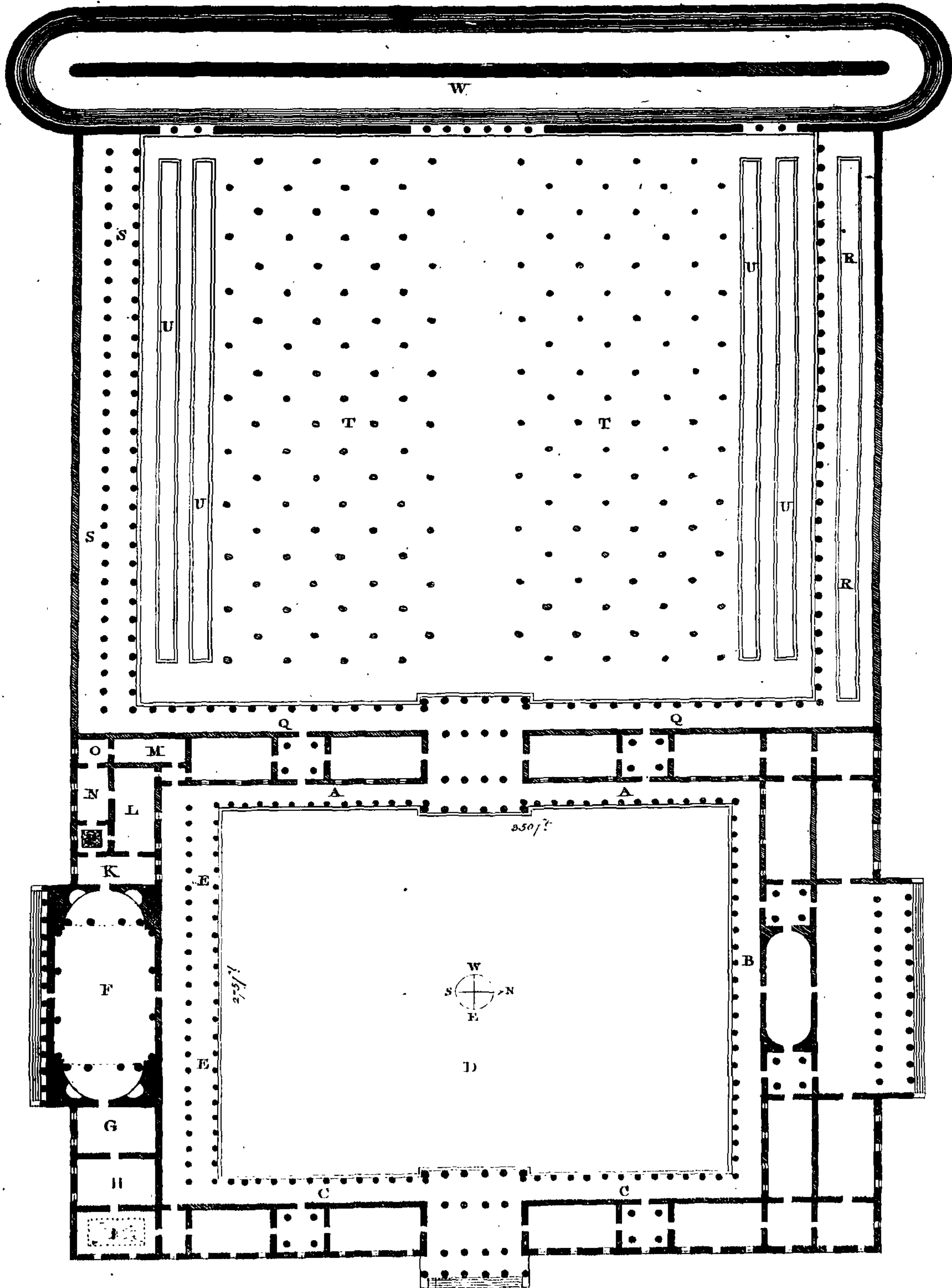


Fig. LI.